Weyerhaeuser's Cosmopolis Dissolving Pulpmill– An Investment Opportunity?

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EXECUTIVE SUMMARY

Executive Summary

Findings

The Cosmopolis pulpmill represents an attractive strategic investment opportunity, most likely for a company committed to serving the rapidly growing Asian viscose and acetate markets. The mill is a proven supplier of high quality acetate pulps to large, demanding Asian acetate customers like Daicel, it is located in an area where it has transportation cost advantages to large volumes of acceptable quality residual and whole tree wood chips, it operates in compliance with currently-applicable environmental regulations (and seems well-equipped to handle likely new regulations), the mill is relatively automated and in a generally good state of repair and it is advantageously located to economically serve the fastest growing dissolving pulp markets in Asia.

Concerns

The largest single concern that we have is timing- will we have enough time to find a qualified buyer before Weyerhaeuser makes the decision to curtail mill operations? The Cosmopolis mill is a very complicated and specialized, relatively low yielding (pulp volume out versus wood volume in) pulpmill that currently serves a highly differentiated, global market- the market for acetate tow and fiber. The market for acetate pulp is very good right now and established competitors, around the world, are busy strengthening their relative competitive positions. While the Cosmopolis mill is a highly-respected, proven supplier of these very technically-demanding acetate pulps, it is known to have high pulp production costs versus the newer, larger scale, prehydrolized kraft mills, especially those like Bacel's new mill in the Southern Hemisphere. Furthermore, a previously idled mill with a similar (albeit, less capable) process, the Port Alice 'Neucel' mill on the north end of Vancouver Island in British Columbia, is reportedly in the midst of a $C100 million renovation to enhance its ability to compete directly for Cosmopolis' valuable acetate customers.

Opportunities

The global markets for dissolving pulp products like acetate seem to be growing again and they are moving to Asia. The costs of U.S. surface transportation are climbing rapidly. These seemingly unrelated trends will likely serve to enhance the relative competitive position of the Cosmopolis mill in the future. There also appear to be opportunities to improve the mill's fiber cost, chemicals cost, energy cost and yield. Two current mill by-products, red liquor that is currently burned for energy recovery and alkaline extraction liquor (which is currently a mill disposal problem), are potentially significant sources of incremental revenue. Based upon a preliminary analysis, our team has concluded that it may be economically feasible to convert the mill's red liquor to ethanol and to convert the mill's alkaline liquor to a PF resin.

MARKETING

LDN, 7/5/2006

Marketing Opportunities for the Cosmopolis Pulp Mill

Summary

The Cosmopolis pulpmill is primarily configured to produce acetate grade chemical cellulose and, while the mill has produced other 'dissolving' pulp grades for market diversification reasons in the past, we believe acetate continues to be the most promising, long-term market for the mill. The acetate pulp market occupies a niche position in the much larger chemical cellulose market, pricing for acetate is normally higher than for other chemical cellulose grades and the acetate market is forecast to grow at 3 to 3.5% per year over the next five years. It is technically challenging to produce acetate pulp and the number of wood species that have successfully been utilized to do so is limited. Western hemlock, the species in greatest abundance in the vicinity of the Cosmopolis mill and the species upon which the mill's process is primarily based, is one of the most proven species for acetate end use applications. Acetate, a relatively low yielding pulp grade, also creates substantial challenges for a 'dissolving' mill's environmental treatment systems, challenges the Cosmopolis mill has successfully addressed over the years. For all of these reasons, while other North American pulp mills capable of producing acetate pulp have continued to close, the Cosmopolis mill's global, acetate pulp marketshare was close to 25% in 2005. And acetate pulp represented over 90% of the mill's production in that same year.

The continued, very rapid economic growth in Asia, primarily China, growing U.S. railroad pricing power and higher global petroleum prices all suggest that the Cosmopolis mill's best future markets are in Asia. The Cosmopolis mill's best, long-term acetate customer has been Daicel in Japan. Global acetate converting capacity is moving to China and China is also the fastest growing market for viscose pulp. Viscose pulp, while not the market the Cosmopolis mill is ideally configured to serve, is the largest, least technically demanding market and a market that could help diversify the mill's product mix during volatile markets. Longer term, North American acetate converting capacity will be in the U.S. Southeast. U.S. Class 1 rail rates have doubled over the past 4 years, the railroads (straining to keep up with very rapid intermodal and coal volume growth) continue to exercise their pricing power and trucking (the most energy intensive mode of surface transportation) rates are soaring. These transportation cost/service disadvantages will make it more and more difficult for the Cosmopolis mill to compete with Rayonier and Buckeye in serving what remains of the North American acetate market.

The Cosmopolis mill has long-standing relationships with the major producers of acetate flake and has developed a family of acetate grades that are well recognized in the industry. Thanks to the technical requirements of this market, the price structure for this market segment has been very stable and has not reflected the volatility of the viscose market (as mentioned earlier, the largest segment in the chemical cellulose arena). This stability and the higher prices for acetate have permitted Cosmopolis, a small, sulphite mill, to profitability compete in an industry now dominated by larger scale and presumably more cost-efficient mills. Looking forward, it is imperative that the mill be acquired by a qualified, presumably Asian buyer in the near future, a buyer that can secure sales agreements with key acetate pulp customers for the remainder of 2006 and more importantly for 2007. A reasonable person would assume that by August/September of this year the Cosmopolis mill's major customers will have established long-term purchase agreements with competing mills. This would obviously place the mill in an untenable financial position.

Overview of Chemical Cellulose Products

Chemical Cellulose (or 'dissolving pulp', as it is sometimes called) is primarily used as a feedstock in chemical processes to manufacture cellulosic fibers. The majority of chemical cellulose is consumed in the production of viscose rayon. Smaller end-uses include cellulosic ethers, microcrystalline cellulose and some non-chemical cellulose applications (such as ground cellulose which is used as a filler in resin compounds).

Supply vs. Demand

Presently, world chemical cellulose production capacity versus demand is at a 20 year low because of the closure of many of the older 'dissolving pulp' mills in North America and Europe. As indicated in the 'World Dissolving Pulp Capacity' exhibit at the end of this section, world capacity for chemical cellulose peaked in 1980 at approximately 6 million air-dried metric tons (the industry's standard unit of measure). We estimate that capacity declined to approximately 3.4 million tons in 2005. This decline is attributed to declining demand for viscose rayon and the virtual disappearance of the cellophane industry as low cost synthetic substitutes were introduced for both products. Another cause for decline of both chemical pulp demand and capacity was the collapse of the Soviet Union.

The decline in both demand and manufacturing capacity of chemical cellulose during the past 25 years is the outcome of three major trends within the industry. The first is the virtual disappearance of the cellophane industry in most of the industrialized world as lower cost and acceptable performance petroleum-based synthetics (polyethylene and polypropylene) now dominate this market. The second is the shift in viscose rayon production from North America and Europe to Asia, primarily India and China.

This geographic shift of viscose staple fiber production (the highest volume rayon fiber type) has been accompanied by backward integration into the pulp business by some of the major Asian chemical cellulose users. The Indian firm Birla has entered into two joint ventures with Canadian chemical cellulose producer Tembec. They will eventually convert two previously closed, paper grade mills in Eastern Canada to chemical cellulose production. The Singapore-based firm Sateri has purchased the Brazilian Bacell mill and is expanding the mill from it's present capacity of 145,000ADMT/yr to 345,000/ADMT/yr. This mill will reportedly produce both viscose and acetate grades from eucalyptus fiber. The viscose grades produced at this mill will apparently be used to source Sateri rayon mills in Finland and China.

The third trend in the industry has been the decline of chemical cellulose capacity in North America and Europe (and, apparently also, in the former Soviet Union) and substantial growth in chemical cellulose capacity in the southern hemisphere. Chemical cellulose producers in the southern hemisphere have lower wood costs (see table below), lower labor costs and less restrictive environmental regulations and hence a significantly lower cost basis compared to existing North American capacity.

Country	Softwood Fiber Growth Rate
Canada	1 m3/hectare/year
Sweden	3 m3/hectare/year
USA	10-15 m3/hectare/year
Chile	25m3/hectare/year
Brazil	30m3/hectare/year

Source: Ernesto Wagner, Weyerhaeuser,

***Western Forester*, May/June 2006**

In addition to the new chemical cellulose capacity in the southern hemisphere, three Canadian mills that were previously closed (including the two previously-mentioned Birla-Tembec joint venture mills) have restarted. One of these mills, the Port Alice mill on the north end of Vancouver Island in British Columbia, is a hemlock-based sulphite mill that will undoubtedly attempt to compete directly against the Cosmopolis mill. All of these mills were purchased at very low prices (one for one Canadian dollar) and Canadian pulpmills that have been shutdown and subsequently restarted typically receive various government subsidies. Whether any or all of these mills can remain economically viable given shifting global end use demand and generally higher North American surface transportation costs is debatable.

The recent industry data indicates that, driven by increasing Asian demand, the world production of cellulosic fiber is now beginning to increase again. Not surprisingly, this increase in demand and stronger pricing has prompted a marked increase in announced chemical cellulose production capacity. Recent announcements include:

Company	Location	Announced New Capacity	Date
Bacell (Sateri)	Bahia, Brazil	240,000 ADMT	2006
St. Anne (Birla/Tembec)	Nackawic, N.B.	263,000 ADMT	2006
Neucell	Port Alice, B.C.	160,000 ADMT	2006
Saiccor	Umkomass, S.A.	200,000 ADMT	2007

In addition to these announced capacity expansions, a recent AF&PA survey identified new industry debottlenecking mill projects that could account for a further 200,000ADMT/yr of chemical cellulose capacity. This "debottlenecked" capacity and the 863,000 ADMT/yr of new or "restarted" capacity would amount to nearly 1,000,000 ADMT/yr of additional supply or approximately 25% of the industry capacity identified in 2005! Will it all happen? If past behavior in the global pulp and paper industry is any indication of future industry behavior, it could. The result would then be precisely as predicted by the simple economic model of 'perfect competition'- the highest cost/lowest quality chemical cellulose mill capacity would be forced to shutdown until supply once again came back into balance with demand and the least efficient, surviving mill just covered its incremental costs. The pulp and paper industry is an industry that has destroyed massive amounts of shareholder value over the past decade through this type of behavior and the industry has recently shown more capacity management restraint but this is very real, very serious risk to a potential new Cosmopolis mill investor.

Chemical Cellulose Markets

The vast majority of chemical cellulose is used in the manufacture of viscose rayon staple and yarn. Globally, viscose rayon staple accounts for more than half of the chemical cellulose that is consumed. After a period of decline, the viscose market has recently experienced a 3%/annum growth driven by new demand growth in Asia The next largest use of chemical cellulose is for acetate tow, yarn and plastics. This accounts for approximately 15% of world consumption. The other uses of chemical are rather diverse and fragmented.

Product Family	Product	End Use Demand (ADMT's)	Chemical Cellulose Demand (ADMT's)
Viscose	Staple	2100	2205
	Yarn	417	438
	Cellophane	80	84
Acetate	Tow	666	446
	Yarn	100	67
	Plastics	65	44
Ethers	CMC	100	50
	Others	100	50
Miscellaneous	Nitration, MCC	130	110
	Grand Total	**3758**	**3494**

The market for chemical cellulose pulp used for viscose staple has historically behaved like commodity markets everywhere- cost based competition and, because each mill has a relative high (compared to the market size) minimum efficient scale, substantial pricing volatility. This price volatility, coupled with the lower general prices compared to other grade alternatives, has driven the production to lower cost mills which are typically in the southern hemisphere.

The technically capable North American mills have understandably tended to focus their efforts on serving the acetate market. The grades in this market have a high technical component and tend to be "custom designed" for an individual customer's process. As a consequence of the technical requirement and the need for consistently high quality, the pricing in this sector has been higher and more consistent than the viscose market. These market characteristics have enabled the Cosmopolis mill to remain financially viable while other North American and European mills have closed over the past few years. As shown in the previous table, 80% of the acetate market is acetate tow for cigarette filters. In spite of litigation, which has increased cigarette prices and decreased consumption in the US, global tow demand continues to grow at the rate of 3-3.5% per year. Tow producers have consolidated production in North America and Europe and the additional capacity has been added in China (see acetate capacity by region) The ethers market is highly fragmented and is nearly evenly divided between CMC (carboxymethylcellulose) and the non-ionic ethers. Each segment represents about 100,000mt of annual pulp demand. The CMC industry generally uses lower grade, technically unsophisticated pulp, pulp that is often close to paper grade quality. The non-ionic grades use more sophisticated grades and require extensive qualification. Due to the high cost of changing pulp sources, chemical cellulose suppliers tend to become entrenched and it should be assumed that it would take considerable time to take marketshare away.

Present Market Configuration of the Cosmopolis Mill

During 2005, Weyerhaeuser announced their intention to close the mill. The company consequently decided to focus all mill production on acetate grades to fulfill contracts with key customers prior to the intended shutdown in late 2006. Our team's estimate of the mill's sales volumes in 2005:

Pulp Grade	Estimated 2005 Volume
Acetate	122,000 ADMT
Molding Compound	6,000 ADMT
MCC	1,000 ADMT
Ethers	3,000 ADMT
Specialty	2,000 ADMT
Total	**134,000 ADMT**

We estimate that the 2005 acetate grade sales were distributed as follows:

Customer	Estimated 2005 Volume
Celanese (Canada)	24,000 ADMT
Rhodia (Germany)	12,000 ADMT
Rhodia (U.S.)	6,000 ADMT
Daicel	55,000 ADMT
Voridian	20,000 ADMT
Eastman	5,000 ADMT

We estimate that the average mill net realization for sales of these grades in 2005 was $823/mt. We also estimated that the mill would choose to run solely on acetate grades until closure final closure, which we estimate to be about September 2006. During this time period, we estimate that the mill will sell 105,000 ADMT. We estimated the distribution of sales to be:

Customer	Estimated 2006 Volume
Celanese (Canada)	24,000 ADMT
Daicel	55,000 ADMT
Rhodia (U.S.)	12,000 ADMT
Voridian	12,000 ADMT
Eastman	2,000 ADMT
Total	**105,000 ADMT**

We estimate that the average net mill sales realization in 2006 will be $869/ADMT.

Our Mill Marketing Plan 2006-2010

Pulp Marketing Assumptions:

As we constructed a pro-forma marketing plan for the continued operation of the Cosmopolis mill, the following areas were addressed:

1) GRADE MIX: The number and volume of individual grades.
2) GEOGRAPHIC MIX: The distribution of forecast sales by geography.
3) AVENUE OF SALE: The sales channel(s) for pulp sale (direct or agency sales?)

GRADE MIX: The pro-forma grade mix was determined by grade margins, mill capability. market demand, competition and the mill's existing customer mix. Over the years, the consideration of these factors has indicated that the highest profit configuration for the mill is a dissolving pulp grade mix that is very heavy to acetate grades. The concentration on one market segment has inherent risks but the continued world wide growth of the market for acetate tow and the closure of competitive acetate mills has left the Cosmopolis mill with a secure market share in this grade category.

The announced expansion of equatorial mill capacity, all supposedly producing eucalyptus acetate grades, poses a serious threat to the older northern hemisphere mills like Cosmopolis but there may be technical issues that prevent a one-for-one substitution for these long fiber acetate pulps.

GEOGRAPHIC MIX: This is largely driven by customer profitability and forecast market conditions. Since acetate market growth is primarily (if not all) in Asia and the mill is situated close to several large Pacific container ports, the focus of sales growth and market/business development should be Asia.

AVENUE OF SALE: The avenue of sale is a key factor in the sale of any pulp grade-particularly chemical cellulose. The technical component in the marketing of chemical cellulose has generally favored the use of a direct sales force in the major markets. Cost is also an issue. The historical cost of selling thought an agent can be between two and three percent of the FAS value. We assumed direct sales in North America and Japan.

Pricing Forecasts:

Since Weyerhaeuser would only reveal the macro mill net prices for 2005 and 2006 to our team, we were obligated to use industry data to reconstruct pricing for individual grades. We developed forecast pricing and volumes for a 'Pessimistic Case' (strong dollar, rapid competitive response, new competitive volume surge and delayed resolution of mill's fate) and for an 'Optimistic Case' (weak dollar, slow competitor start-up and prompt resolution of mill fate).

Optimistic Case

Key Assumptions

1) The value of the dollar will erode significantly in relationship to other major currencies.

2) Pt. Alice will have an unsuccessful start-up and will be incapable of producing a quality acetate grade for the next several years.

3) Over time eucalyptus will not be able to replace existing grades on a one-for-one basis for the manufacture of acetate flake. Introduction will take 3-5 years.

Pulp Grade	**Estimated 2005 Price**	**2006 Price Assumption**	**2007 Price Assumption**	**2008 Price Assumption**	**2009 Price Assumption**	**2010 Price Assumption**
MAC	950	1025	1025	1025	1025	1050
MACII	950	1025	1025	1025	1025	1050
WEYCELL	925	975	975	950	950	1000
TRUCELL	1000	1075	1075	1025	1025	1050
PH	600	650	650	650	650	700
ETHER	950	1025	1025	1025	1025	1025
VISCOSE	670	680	680	680	680	700
FLUFF	700	750	750	750	750	800

Pessimistic Case

Key Assumptions

1) The value of the dollar will not weaken in relationship to other major currencies.

2) Pt. Alice will have a successful start-up and will be capable of producing a quality acetate grade within this year.

3) Over time,(1 year or less), eucalyptus will become a major raw material for the manufacture of acetate flake.

4) A surge in new chemical cellulose capacity weakens price structure of acetate market in 2008.

Pulp Grade	Estimated 2005 Price	2006 Price Assumption	2007 Price Assumption	2008 Price Assumption	2009 Price Assumption	2010 Price Assumption
MAC	950	1025	1025	1000	1000	1000
MACII	950	1025	1025	1000	1000	1000
WEYCELL	925	975	975	950	950	950
TRUCELL	1000	1075	1075	1025	1025	1025
PH	600	650	650	650	625	625
ETHER	950	1025	1025	1025	1025	1025
VISCOSE	670	680	680	650	650	650
FLUFF	700	750	750	750	700	700

Discounts and Freight:

1) Discounts and allowances:

Daicel-5 %

Rhodia-3%

Eastman/Voridian-$ 100/ADMT-2005, 4%-2006

Celanese-4%

Nantong-4%

2) Estimated Freight Costs

Daicel- $60/ADMT

Rhodia- $100/ADMT plus transshipment

Eastman- $100/ADMT plus transshipment

Celanese- $50/ADMT:

3) Estimated Agents' Commissions

CPP/PH 2%CIF Gross

Nantong/Weycell 2% Gross

Ethers-2%CIF Gross
Viscose-2%CIF Gross

KEY SALES VOLUME ASSUMPTIONS

Optimistic Case

1) Mill will run exclusively on acetate grades in 2006 to fulfill outstanding contracts. If mill runs to September this should amount to 105,000 metric tons. If the mill should continue running there would be an order deficit in the fourth quarter of 2006 since the contractual commitments for acetate would have been filled leaving little to run in the latter part of the year.

2) Celanese Edmonton is closing in late 2006 or January 2007. This is a key customer representing 22-24,000 metric tons of high margin acetate business with an attractive freight rate from Cosmopolis.

3) Rhodia Germany has secured volume formerly supplied by Cosmopolis from Attiholtz.

4) Voridian has covered plastic grade requirements from Rayonier.

5) Port Alice to start in early May 2006 and not capable of producing quality acetate grades for three to four years

6) Bacell starting expansion in second half of 2007. Introductions take one to three years and are not completely acceptable one-for-one substitutes for present grades.

7) Assume up to 20,000mt per year of viscose pulp sales to compensate for lost acetate volume.

8) Nantong (China) will expand acetate flake production from 60,000 metric tons to 124,000 metric tons by 2007. This will increase pulp consumption by 40,000mt per year and Cosmopolis sulphite will be qualified.

9) Major customers will have some difficulty replacing the Cosmopolis volume. The customer having the most difficulty is Daicel.

Customer	Pulp Grade	2006 Vol. Assumption	2007 Price Assumption	2008 Vol. Assumption	2009 Vol. Assumption	2010 Vol. Assumption
Daicel	MACII	48,000	25,000	25,000	25,000	30,000
	TRUCELL	7,000	7,000	8,000	8,000	10,000
Rhodia-US	WEYCELL	18,000	24,000	24,000	24,000	24,000
Voridian	MAC	12,000	12,000	18,000	18,000	18,000
	TRUCELL	5,000				
Cel.- Canada	MAC	24,000				
CPP/Others	PH	4,000	9,000	9,000	9,000	9,000
Nantong	WEYCELL		3,000	12,000	12,000	12,000
FMC	PH		1,000	1,000	1,000	1,000
	ETHERS		1,500	1,500	2,000	3,000
Asia	FLUFF					
	Viscose	12,000	20,000	20,000	20,000	20,000
	Total	**130,000**	**102,500**	**118,500**	**119,000**	**127,000**

KEY SALES VOLUME ASSUMPTIONS

<u>Pessimistic Case</u>

1) Mill will run exclusively on acetate grades in 2006 to fulfill outstanding contracts. If mill runs to September this should amount to 105,000 metric tons. If the mill should continue running there would be an order deficit in the fourth quarter of 2006 since the contractual commitments for acetate would have been tilled leaving little to run in the latter part of the year.

2) Celanese Edmonton is <u>closing</u> in late 2006 or January 2007.This is a key customer representing 22-24,000 metric tons of high margin acetate business with an attractive freight rate.

3) Rhodia Germany has secured volume formerly supplied by Cosmopolis from Attiholtz

4) Voridian covered plastic grade requirements from Rayonier.

5) Port Alice to start in early May. This will be capable of producing quality acetate grades this year (2006) with Voridian and Daicel as target customers.

6) Bacell starting expansion in second half of 2007. Introductions take one year of less.

6) Nantong (China) will expand acetate flake production from 60,000 metric tons to 124,000 metric tons by 2007. This will increase pulp consumption by 40,000mt per year and Cosmopolis sulphite will have difficult and lengthy introduction.

7) Major customers will have secured positions with existing suppliers to replace majority of Cosmopolis volume.

8) To compensate for lost acetate tonnage, assume mill can produce and sell up to 20,000mt of viscose pulp.

Customer	Pulp Grade	2006 Vol. Assumption	2007 Price Assumption	2008 Vol. Assumption	2009 Vol. Assumption	2010 Vol. Assumption
Daicel	MACII	48,000	25,000	25,000	25,000	30,000
	TRUCELL	7,000	7,000	8,000	8,000	10,000
Rhodia-US	WEYCELL	18,000	18,000	18,000	18,000	18,000
Voridian	MAC	12,000	12,000	12,000	12,000	12,000
	TRUCELL	5,000				
Cel.- Canada	MAC	24,000				
CPP/Others	PH	4,000	9,000	9,000	9,000	9,000
Nantong	WEYCELL		3,000	6,000	12,000	12,000
FMC	PH		1,000	1,000	1,000	1,000
	ETHERS		1,500	1,500	2,000	3,000
Asia	FLUFF					
	Viscose	12,000	20,000	20,000	20,000	20,000
	Total	**130,000**	**96,500**	**100,500**	**107,000**	**115,000**

Key Market Segments:

a) Acetate:

For a relatively small mill, the Cosmopolis mill is uniquely capable of producing acetate pulp. This capability has evolved over a number of years and has enabled the mill to remain profitable through a number chemical cellulose market cycles. The heavy focus on acetate does have some risk but this risk is mitigated to some degree by the mill's reputation for quality and long-term relationships with major customers. As with viscose, the acetate market has consolidated and shifted toward Asia. The demand for this market in 2008 is estimated and shown below:

Estimated Acetate Pulp Consumption by Consumer/ Region (thousands of air dried metric tons)

	North America	Western Europe	Japan	China	Total
Voridian	190				190
Celanese	90			30	120
Daicel			97		97
Rhodia/ Primester	28	50			78
Acetate Pd.		40			40
Nantong				54	54
Acetati		16			16
Total	***308***	***106***	***97***	***84***	***595***

As noted, the capacity to consume acetate pulp is concentrated on the east coasts of North America and Asia (China and Japan). The market growth has been and will continue to be in Asia. In addition to acetate pulp, much of the North American flake production is also flowing to China to meet the seemingly ever-growing demand. It is estimated that, for the next five years, the global growth of acetate tow will be between 3 and 3.5%.

b) Viscose:

The Cosmopolis mill has a limited capability to serve this very volatile and competitive market. The mill has limited sheet size flexibility and cannot presently make the 60 cm. x 80cm. required by much of the industry. In addition, the dry end of the machine cannot currently densify the pulp sheet to meet most end-user requirements. Previously the mill has only supplied the domestic cellophane industry which used sheet steeping (where sheet density was not an issue). The sum total of the foregoing liabilities makes the currently configured mill uncompetitive in this market. The need for the mill to produce viscose until such time as it can be filled with acetate is a financial liability and it gives a strong impetus to find more attractive alternatives. The chief concern is that the marketing of viscose would be in the "bid" markets which most often tend to erode pricing and make it difficult to plan production.

c) Ethers:

The entire ethers market represents about 200,000 ADMT of pulp volume. Half of this market is industrial grade CMC which can use low quality pulp as feedstock. The remainder of the market represents high quality technical grades of ether used in food stuffs and other quality sensitive applications. The high quality market is fragmented and represents many customers and grades but it is very stable and profitable. The Cosmopolis mill spent close to a decade developing an ether grade for Shinetzu in Japan. The grade in question was a derivative of an acetate grade and yielded similar margins. To develop a significant volume of specialized ether grades might take as much as a decade of product development and marketing.

d) Molding Compounds:

The mill developed the grade "PH Sulphite" which became the standard in the industry for the manufacture of molding compounds. The mill has robust screening and cleaning capacity and can meet the stringent cleanliness of this industry. Unfortunately, the molding compound industry has virtually all moved to Asia with many of Cosmopolis' North American competitors closing over the last decade. This grade runs very well in the mill and is more profitable than viscose.

Conclusion:

The only financially viable course of action for the mill to pursue is to maintain as much of it's hard won acetate market position as it can. In 2005, we estimate the mill's contractual acetate position was 122,000ADMT. The closure of one of the mill's major customers, Celanese Canada, in late 2006 and the loss of Rhodia Germany to Attiholz reduces this contractual base by approximately 36,000mt. This loss makes the retention of a significant portion of the present Daicel volume crucial for the mill's financial survival. If Daicel has already secured most of the Cosmopolis volume from other suppliers on a long- term contractual basis, the retrieval of this volume would be close to impossible unless the other suppliers are unable to perform on their contracts.

World Dissolving Pulp Capacity

Company/Location	1950	1960	1970	1980	1990	2000	2005	2010	
NORTH AMERICA									
CIP/Temsc.(Tembec)	165	165	165	75	75	75	75	75	
CIP/Hawksbury	100	100	100	100	shutdown				
Rayonier/Pt.Angeles	160	160	160	160	160	shutdown			
Rayonier/Pt.Alice(Western)	170	170	170	170	170		shutdown	170	Restart
Rayonier/Hoquiam	80	80	80	80	80	shutdown			
Rayonier/Fernadina Beach	145	150	150	150	150	150	150	150	
Rayonier/Jesup		100	250	250	250	300	300	300	
Canadian Cellolose/Skeena		150	shutdown						
Weyco/Everett	100	100	100	shutdown					
Weyco/Cosmopolis		140	140	140	140	140	140	140	
Ketchikan Pulp/LP			200	200	200	shutdown			
APC/Sitka			180	180	180	shutdown			
Buckeye/Foley		180	180	180	180	180	180	180	
IP/Natchez		350	350	350	350	350	shutdown		
Tembec/Birla(Atholville)						110	110	110	New
Tembec/Birla(St.Anne)								250	New
Bellingham/GP	40	40	40	40		shutdown			
Rayonier/Pt.Cartier				250	shutdown				
Sub-Total	960	1885	2265	2325	1935	1305	955	1375	
WESTERN EUROPE/SCAN.									
Borregaard/Switz.							135	135	New
Borregaard/Norway	160	160	160	160	160	160	160	160	
SNIACE/Italy	65	65	65	65	65	65	65	65	
Rauma/Finland	75	75	75	75	75	shutdown			
Metsa/Finland	70	70	70	70	70	70	70	70	
Serlachius/Finland	100	100	100	100	100	shutdown			
Lenzing/Austria	134	134	134	134	134	134	134	134	
Furoli/Italy	65	65	65	65	65	shutdown			
Westalishe/Germ	40	40	40	40	40	shutdown			
Swabishe/Germ.	65	65	65	65	65	shutdown			
Domsjo/Sweden	200	200	200	200	200	200	200	200	
Billerud/Sweden	100	100	100	100	shutdown				
Iggersund/Sweden	60	60	60	60	shutdown				
Udderholms/Sweden	60	60	60	60	shutdown				
Waldorf/Germany	55	55	55	55	shutdown				
Alhisay/France	70	110	110	110	shutdown				
Sub-Total	1319	1359	1359	1359	974	629	764	764	
ASIA									
Jujo/Jpn.	140	140	140	140	shutdown				
Sanyo(Goto)/Jpn	115	115	115	115	115	115	115	115	
Sanyo(Iwak)/Jpn	55	55	55	55	55	55	55	55	
Kojin/Jpn.		70	70	70	70	shutdown			
Taiwan Pulp/Taiwan	65	65	65	65	65	shutdown			
Grasim/India	50	50	140	140	140	140	140	140	
SIV/India		50	50	50	50	50	50	50	
Century Rayon/India			30	30	30	30	30	30	
APR/India			65	65	65	65	65	65	
Indorayon/Indonesia				180	180		180	180	New
Sub-Total	425	545	730	910	770	455	635	635	
AFRICA									
Saiccor		35	90	360	400	600	600	800	Expansion
Sub-Total		35	90	360	400	600	600	800	
SOUTH AMERICA									
Bacell		72	142	142	145	145	145	345	Expansion
Sub-Total		72	142	142	145	145	145	145	
RUSSIA/EASTERN EUROPE	100	739	800	900	1000	800	300	300	Contraction
Sub-Total	100	739	800	900	1000	800	300	300	
TOTAL WORLD CAPACITY	2804	4635	5386	5996	5224	3934	3399	4019	
REPORTED WORLD PRODUCTION (FAO)				4757	4470	2893	3200 estimate		
APPARENT EXCESS CAPACITY				1239	754	1041	199		

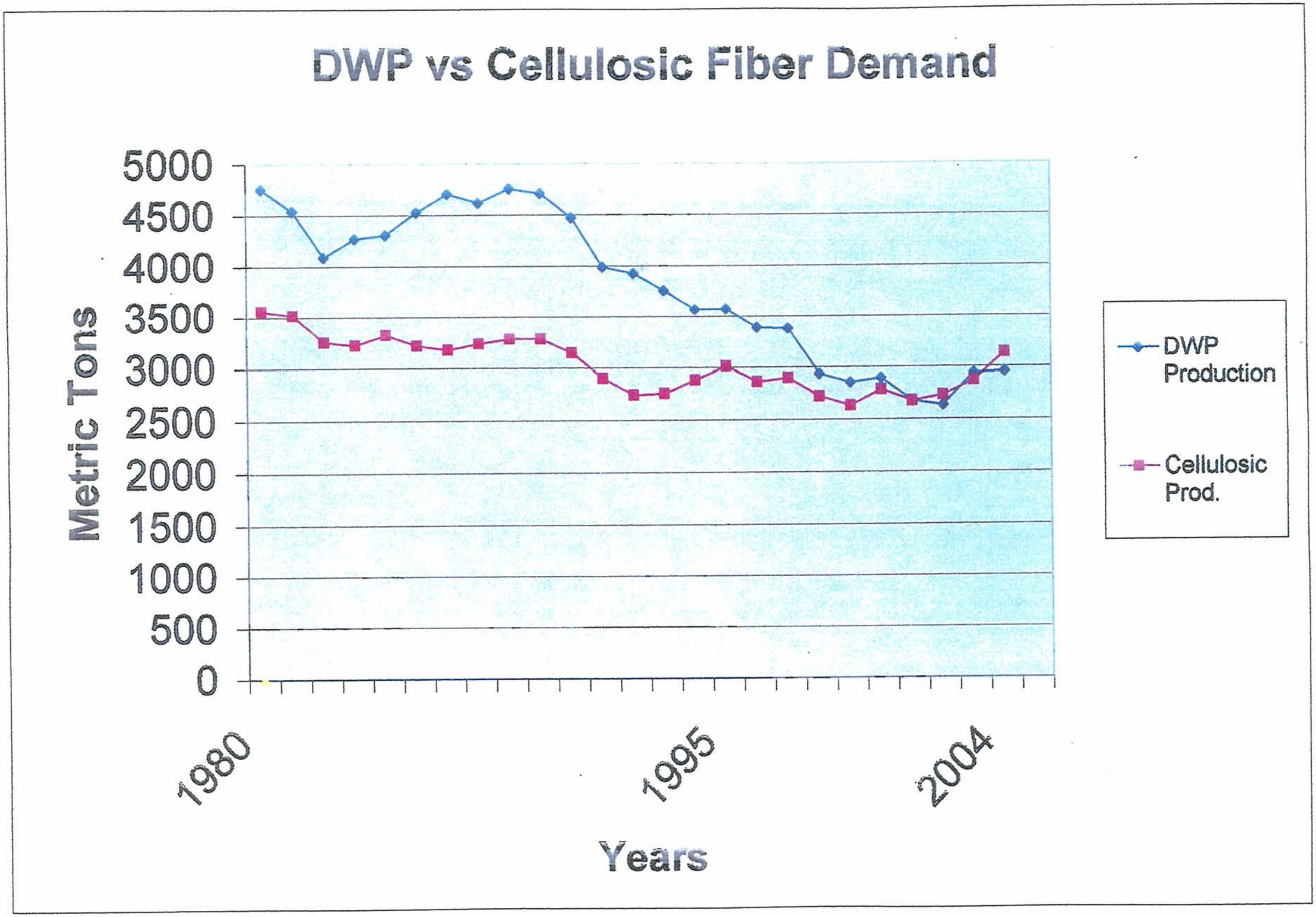
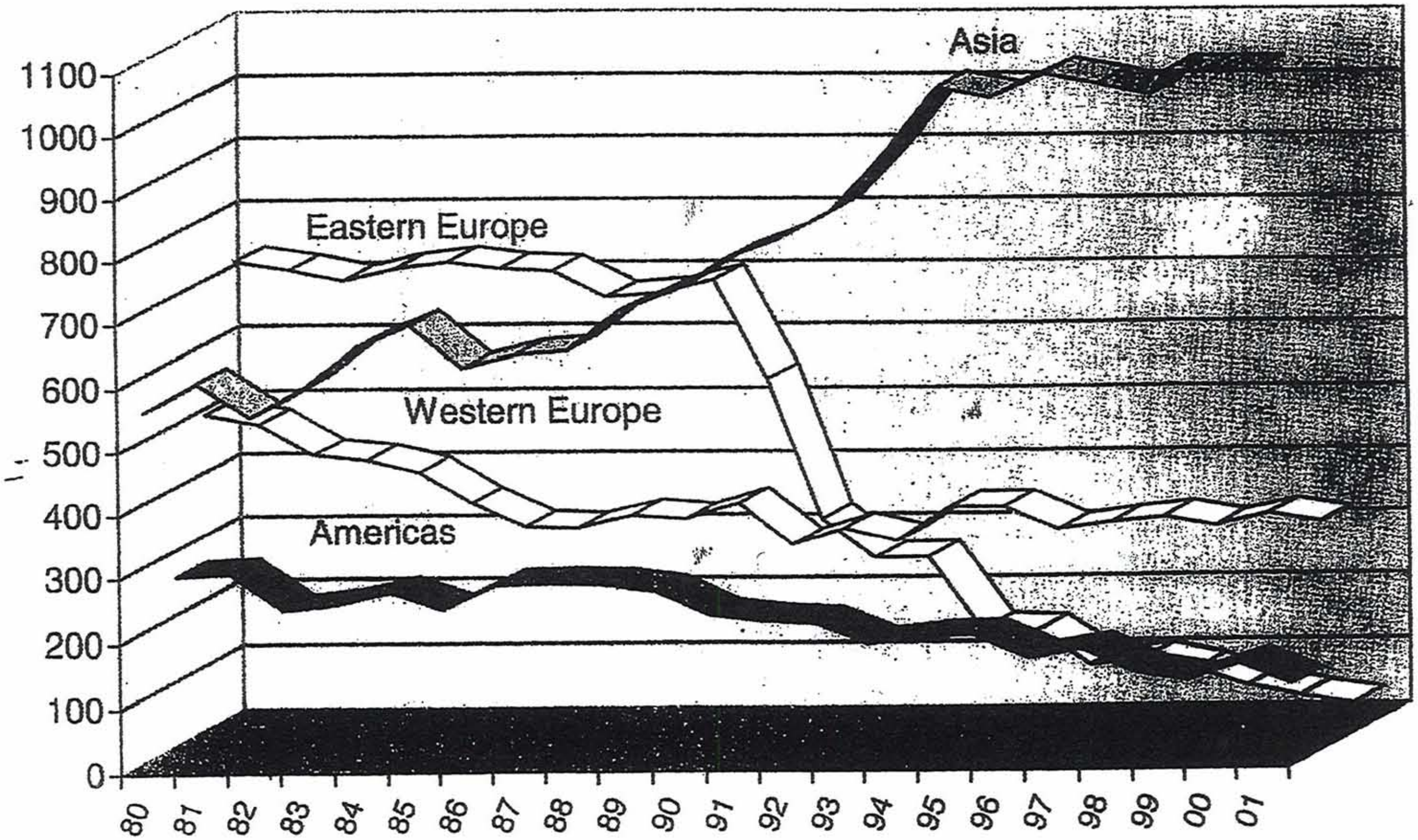

DWP vs Cellulosic Fiber Demand
Metric Tons
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1980
1995
2004
Years
DWP Production
Cellulosic Prod.

FIGURE 1
CELLULOSIC STAPLE PRODUCTION: 1980 TO 2001



July 2002

PROCESS

Cosmopolis Pulpmill Process

Background

The Cosmopolis pulpmill uses the acid sulphite cooking process. The mill's sulphite cooking process is magnesium-based. Spent cooking liquor is evaporated and burned to recover magnesium oxide and sulfur dioxide. Bleaching is accomplished in a 5-stage bleach plant using chlorine dioxide (D), oxygen (O), sodium hydroxide (E) and hydrogen peroxide (P). The mill's most often used bleaching sequence is D-O-E-D-P. The oxygen and extraction stages are pressurized. After bleaching, the pulp is cleaned and then dried on a fourdrinier pulp machine. The sheet may then be processed into bales or roles. The mill has sizeable warehouse facilities for on-site pulp storage.

Built in 1957 to be a paper-grade sulphite mill, the Cosmopolis mill quickly evolved into a producer of specialty grades. As mentioned in Terry Roarke's marketing section, the mill's dominant product is now an acetate grade. Historically, the mill has produced almost every sulphite specialty dissolving pulp product. Rail service to the plant was eliminated several years ago. All materials and supplies arrive by truck and all product leaves the mill by truck.

Recent Capital Upgrades

Significant new capital investments, in recent years, include: 1) A bag house collector for the power boiler hog fuel dryer exhaust, 2) a new electronic drive system for the pulp machine and 3) new vacuum equipment for the pulp machine wet end.

Mill Maintenance Condition

Weyerhaeuser's intention to close the mill was announced in October, 2005. The mill has operated continuously since that time to meet contractual customer commitments (once again, see Terry Roarke's marketing section for details). Prior to the October announcement, the mill was being properly maintained, actually being upgraded for on-going operation. Since that time, certain maintenance activities have been eliminated or deferred, always (if required) with the explicit agreement of the company's insurance carriers and the various applicable state agencies. Deferred activities include annual inspections of all boilers and the biannual inspection of all pressure vessels. Both turbine generators are due for 5-year tear down inspections. Presumably, the mill is also behind schedule on digester inspections and steam safety valve recalibration. Instruments, quality control and quality assurance systems were previously maintained to ISO9002 registration standards. This registration was allowed to lapse in April 2006. The painting program to protect structural steel is also, of course, behind schedule now. Beyond these exceptions, the mill is well maintained and fully operable.

Quality Assurance and Control

The mill operates an effective quality assurance and control system which, coupled with relatively sophisticated and capable process equipment, results in the production of very well regarded dissolving pulp products. As mentioned earlier, prior to April 2006, the mill was registered to ISO9002. The current off-quality rate is reportedly less than 2%, all of which is reprocessed and sold as 'prime' pulp.

By-Products

The Cosmopolis mill has always operated a full red liquor recovery cycle and never participated in any of the possible sulphite by-product markets- with one exception. In the late 1960's, the mill briefly produced acetic acid. The process to produce the product worked but the product was unprofitable. This process has long been closed and the equipment dismantled. However, given current ethanol pricing and demand, an ethanol plant (associated with the mill), would appear to be an attractive potential investment. (See the 'Alternatives' section of this report).

Currently, extraction stage filtrate is concentrated at the mill and sold to kraft mills (apparently Port Townsend Paper Company- Port Townsend, Washington and Weyerhaeuser's Springfield, Oregon mill) as a source of sodium and energy. Returns are not good and neither mill apparently wishes to continue to take the waste liquor. Continued sales of this material are obviously required if the mill is to: 1) continue to focus primarily on the low yield, high purity acetate grades and 2) continue to meet its environmental compliance obligations. Krishan Sudan of Paneltech has recently produced an acceptable quality, lab-scale PF resin from this waste liquor and, if the mill continues to operate and the mill owner is willing to enter into a commercially acceptable agreement with Paneltech, further tests will be conducted on the new resin in commercial wood and paper binding uses. Given current phenol prices, this could also be a very attractive new opportunity for the mill.

Organization

The Cosmopolis pulpmill currently belongs to Weyerhaeuser's Pulp Business Unit which manages sales and product logistics. Virtually all sales are direct (or 'inside') with sales agents rarely employed. Most service functions (such as accounting, purchasing, accounts payable, etc.) are managed at consolidated levels (are not part of the current mill's organization). Scott Olmstead has estimated the requirements for moving these functions back to the mill level and included them in his pro forma financial estimates. As the former controller for Rayonier's Fernandina Beach, Florida dissolving sulphite mill- the Cosmopolis mill's most direct U.S. competitor- he has an excellent understanding of what would be required. Research and development, certain environmental services and legal support have also been centrally managed in the past for the Cosmopolis mill.

Prior to the closure announcement in October 2005, mill staffing included approximately 235 people. Of those, 195 were included in a labor bargaining unit (AWPPW Local 211). The currently applicable labor contract is of the union shop variety. Forty salaried workers have also been engaged in 'non-bargaining unit work', including supervision, professional occupations, logistics and scheduling activities. With no clearly identified prospect for continued employment at the mill, many of this group have either been reassigned within Weyerhaeuser, have left for other jobs in the industry or have indicated that they will retire at the time of mill closure. Some bargaining unit employees, generally those with fewer years of service, have also chosen to pursue other jobs despite the company's apparent offer of a mill severance package for those who choose to stay on until the mill is closed. Perhaps 10 hourly employees have left as the time of this writing.

Like most pulp and paper mills in the U.S., the Cosmopolis mill has substantially automated and reduced its work force over the past 25 years from a high of about 380. It is important to note that, at that time of higher staffing, the mill also ran a log sorting yard and chip plant. Those activities were subsequently contracted out.

Labor Relations

Historically, the relations between Weyerhaeuser and the AWPPW, in general, and Local 211 in particular, could be described as mixed. Strikes, involving all Weyerhaeuser AWPPW mills, occurred in 1971, 1978, 1983 and 2002. All of these strikes occurred at times of contract renegotiation. All ratified and signed labor agreements for the mill have called for no strikes during the contract term (binding arbitration to settle disputes) but, on a few rare occasions, workers have briefly refused to cross a picket line established by another union. Arbitrations generally have arisen from disputes over work rule implementation or from the use of contractors for maintenance and capital improvement work. These disputes have obviously been time-consuming for managers and disruptive to mill operations. The AWPPW historically sought to restrict maintenance to craft lines and that, at times (according to Truman Seely), also led to less than desired mill efficiencies. With the negotiation of 'multi-craft' and with the increased recognition by the union of the need for greater mill competitiveness, these problems were (once again, according to Truman) greatly diminished.

The above said, Truman believes that Local 211 has in many ways been a willing partner in the mill's previous successes. They have always recognized the importance of customer service, product quality and operational effectiveness. They have not resisted technological developments that have led to work force reductions nor have they felt compelled to zealously defend the jobs of people who have behaved irresponsibly. They have willingly united with mill management in the past on issues important to the mill- from customer relations to environmental regulation.

- **Apparent Process/Product Opportunities**
    - 'New' Grade Production opportunities:
        - Relatively high or intermediate viscosity, high R-10 grades would be seem to be insulated from kraft grades in the market, to some degree.
            1. Ethers
            2. MCC
            3. Nitration(?)

- Short term:

1. molding compound
2. fluff rolls in Asia, unsoftened or softened
3. ultra high cleanliness papers?
4. Grays Harbor Paper?

- Process change opportunities

  - Mill seems to be sub-optimized for energy (oil and purchased electricity verses hog fuel, MEE's vs. VCE)

  - Chemical usage may be higher that necessary

  - Reported yield seems slightly low

  - Possible fiber furnish changes to balance availability

  - Ethanol production would probably be attractive (see the 'Alternatives' section and the discussion of ethanol opportunities)

  - There appears to be a better opportunity for the sale of alkaline extraction liquor (PF resin?)

<u>Equipment/Process Detail and Apparent Process/Product Opportunities</u>

- **Chip Supply**

  - 3 chip dumps, truck only delivery
  - Close, long term contractual relationship with an off site chipper (Local Manufacturing)
  - Recent chip suppliers

    - Weyerhaeuser Aberdeen Sawmill

        - Sierra Pacific
        - Dahlstrom Sawmill
        - Allen Log
        - Oakville Forest Products
        - Local Manufacturing (custom chipping)
        - Weyerhaeuser Raymond Sawmill

    - Emphasis on fresh chips and small chip inventories

    - Pretty much a 2 species operation now, primarily hemlock and some Douglas fir

    - Historically could do 4 sorts

    - Chip screens and re-chipper on top of silos

    - chip silos (5-7 cooks/ silo)

    - Chip drag re-claimers for outside storage

- **Cooking**

    - 9 batch digesters, ~ 9000 ft 3
    - Current minimum cook spacing is 55 minutes or 26 cooks/day
    - 495 minute cycle time or 8.25 hours

    - Rough time distribution

        - Fill 50 minutes
        - Steam 185 minutes
        - Time at temp 200 minutes
        - Blow down 45 minutes
        - Dump & check 15 minutes

    - Minimum design spacing is 52.5 minutes or 27 cooks/day

- Filling is steam assisted
- Fast temperature rise increases rejects
- 40% Douglas fir leads to heavy (barely tolerable) rejects (cooked up to 70% in the past, sometimes with terrible results, but 50% was generally tolerable)
  - Other species historically cooked:
    - Alder with some cottonwood) up to 75%
    - Cedar (up to 50% with 50% Alder)

- **Washing and Screening**
  - Digesters are pumped out after cooking. Red liquor is used to dilute in pump out cycle. (1 per dump tank)
  - Pulp is stored in a dump tank (with agitation), transferred to constant head tank then delivered at a controlled rate to the brown stock washers.
  - After #3 washer the pulp goes into a soak tank (agitated, with approximately 30 minute retention).
  - Then over vibratory knotters and on to #4 washers.
  - From #4 washer the pulp is delivered to one of two brown stock medium consistency storage tanks.
  - Pulp is transferred to the screens via a low density blending tank then through a dilution header.
  - After screening the pulp passes directly over a washing decker and is re-diluted and pumped to screened low density storage.
  - Water is used for washing on the brown decker and flows countercurrent forward. (5 washing stages)

- Digesters: Welded carbon steel shell, cement or fiberglass membrane overlaid by 2 courses of brick. Outer course is carbon.

    - Inside volume~9000cts.
    - Indirect heating

- Dump tanks: Brick lined carbon steel agitated with pedestal mount central agitator

- Washers: 11.5 ' x 16' Impco vacuum drum washers (cone end valve type), drums rebuilt to anti-rewet design in 90's

- Decker: Impco 20'x12'(?) vacuum type, flat face valve

- Knotters: Vibratory

- Screens: Primary/secondary/tertiary cowans with KX style rotors Secondary and tertiary accepts feed radiclone cleaners (5 effective stages). Primary cleaner accepts join primary screen accepts.

- **Bleaching**

    - The bleaching system consists of five stages, two of which are combined without washing.:

    - The nominal first stage is an upflow low consistency tower (3%), with a central agitator, delivering pulp to #1 bleached washer 11.50 x16. Originally a chlorination stage, it is now normally used as a chlorine dioxide stage

    - Following the first stage stock is heated and pumped into an upflow tower which functions as a pressurized oxygen stage. Following oxygen the pulp goes through a blow tank and degassing mc pumps to a downflow pressurized caustic extraction stage. From there it is pumped to two stages of vacuum drum washing. The first of these is an 12'x18' Kamyr washer of end valve type, the second an 11.5'x16' Impco. Washing on these stages is countercurrent with filtrate to evaporation.

- The next stage is usually an upflow/downflow mc tower normally used for chlorine dioxide bleaching. Alternately the sequence may be exchanged with the next stage. After washing the 11.5'x16' Impco, the pulp goes to the next and final stage.

- The final bleach stage is mc batch cells with central screw agitators. Usually it is a peroxide stage. The stage washer is again 11.5'x16' Impco. After this stage, the normal route for stock is to one of two bleached medium consistency tanks.

- From the MC tanks, the pulp is transferred to a low density tank in the machine system.

- **Machine**

Pulp flows from the low density chest to screening and cleaning. From the chest, pulp flows to the headbox system via a stuff box, then on to dewatering and drying by more or less conventional means. The sheet from the dryers goes either to the machine cutter layboy (or now, more commonly) to the reel system where it is made into jumbo rolls. Jumbo rolls are transferred to the winder and converted to rolls which are weighed, labeled and sent to the warehouse for shipment.

- Screens- Cowan rotary atmospheric, 3 stages

- Cleaning- Centricleaners. Stages 1-3 Bauer 3 ½", Stages 4,5- Bauer 6"

- Headbox- Beloit Converflow

- Fourdrinier- Cantilever roll out type, table rolls, foils, wet and dry boxes, lump breaker, manual pickup

- Dryers: Minton (52 drums?) Flakt
- Sheet cooler
- Densifying press
- Winder: Cameron, rebuilt several times. Purchased used in the '60s
- Machine width 162' (?) trim ~ 148"

- **Miscellaneous**
  - Fiber recovery system
  - Acid storage and accumulators
  - Red liquor storage
  - Hot water heat exchange and storage
  - Chlorine dioxide generation (Solvay process)
  - Water treatment
  - Primary spill collection
  - Secondary treatment
  - Surge lagoons
  - Spoils area

- **Knots and Tailings**
  - Knots are collected and trapped to remove metal and rock, then refined
  - Refined tailings are washed and dewatered then pumped to the powerhouse, drained and pressed and added to hog fuel.
  - Filtrate system is closed to #3 filtrate tank.

- **Power and Recovery**

    - Evaporators: red liquor, motor-driven vapor recompression unit plus 6-effect unit by CBI

    - Extract filtrate: turbine-driven vapor recompression unit, plus 4-effect CE unit

    - Powerhouse principal equipment

        - Boilers all 930 psig, 825 F

            - Red liquor boilers

              1 115,000 lb/hr
              2 115,000 lb/hr
              3 80,000 lb/hr

            - Power boiler (hog fuel and oil): divided firebox, stationary grate design 180,000 lb/hr

  - All boilers are extended air heater design and lack economizers

  - Feedwater heating is by external heat exchangers

  - Turbine generators

    2- 7.5 MW: #1- ex 50 psig, eh 2"hg, #2 ex 150, eh 50

  - Hog fuel dryer with fluid bed burner, rotary type

FIBER

Fiber Procurement Opportunities for the Cosmopolis Pulp Mill

Background

The Cosmopolis pulpmill is located in the middle of the range of the western hemlock ('hemlock') tree, a range which extends along the Pacific Coast from the California-Oregon Border up through Southeast Alaska. Growing in these predominantly hemlock timber stands are smaller quantities of sitka spruce ('spruce') trees and an even smaller volume of 'true' fir trees. For many, many decades, hemlock, but also some spruce and a smaller volume of alder, Douglas fir and 'true' fir, have been utilized by this area's sulphite pulpmills to produce viscose, acetate and ethers dissolving pulp grades.

Over time the older dissolving sulphite mills have closed (e.g. Rayonier- Hoquiam, Wa, Rayonier- Port Angeles, Wa, Alaska Pulp- Sitka, Ak, Ketchikan Pulp- Ketchikan, Ak) and today only two mills remain in operation- the Cosmopolis mill which Weyerhaeuser has announced that they intend to close this year and the Port Alice, BC ('Neucel') mill which has recently been restarted after years of intermittent operations.

So why has the Cosmopolis mill, a small and unique old mill in Weyerhaeuser's massive portfolio of assets, survived while other hemlock fiber-based sulphite mills (and even a much larger, presumably much more efficient International Paper PHK mill in Natchez, Mississippi) have failed? In the marketing section of this report, Terry Roarke attributes the mill's survival to its focus on the production of high quality acetate grades. That is undoubtedly true but there are other reasons. Hemlock fiber supplies in Western Washington have actually increased in recent years as sawmillers have expanded capacity to serve the hot U.S. housing market (generating more, lower cost sawmill residual chips) and as the global competition for Western Washington hemlock logs has declined. On the other hand, hardwood fiber costs in the U.S. South, due to heightened OSB pulplog competition, more stringent harvesting restrictions and other factors, have escalated rapidly. While prices have more recently leveled off, between 1988 and 1998, hardwood pulpwood prices across the U.S. South escalated by roughly 12% per year!

Our company has completed Western Washington timber-supply consulting assignments for clients in the past and, while the detailed results of those studies are proprietary, the general statistics are well known. The harvest of Western Washington whitewood (mainly hemlock but some spruce and true firs) was well over 1.5 billion board feet in 1990 and it dropped to about 1.2 billion feet in the mid-1990's. It has since stabilized and, while Douglas fir has generally been replanted on harvested areas, it will likely remain at roughly that same level for the foreseeable future. Log exports, especially exports of hemlock and spruce logs, have dropped very sharply from Western Washington in recent years. In 2000, 138 MMBF of logs (mainly Douglas fir but also sizeable volumes of whitewoods) were exported from Grays Harbor to Asia. In 2005, only 65 MMBF of logs were exported from Grays Harbor to Asia (almost exclusively by Weyerhaeuser) and almost all of this volume was Douglas fir. Roughly 10% of the volume harvested only has value as pulpwood and, of the logs that are converted to lumber in a typical sawmill, about 40% of the cubic volume must be produced as chips.

Hemlock pulplogs have been purchased by two independent whole log chipping contractors in the Grays Harbor Area for many years. The chips produced by these contractors have been loaded aboard barges (each independent contractor also owned and operated their own chip barge loading operation) or loaded aboard and transported by truck, generally to pulpmills along the Columbia River. Weyerhaeuser has occasionally chosen to buy some of these chips but most of them have been sold to others. Weyerhaeuser now apparently believes that it can achieve significant fiber cost savings by curtailing Cosmopolis pulpmill operations and by routing local, company-controlled hemlock fiber to its Longview operation. This action would logically increase hemlock fiber supplies in the Columbia River area but, unless Weyerhaeuser ignores market prices (or the action has a significant price discrimination effect), it wouldn't seem to substantially change fiber costs in that area- any fiber cost reductions would also logically be shared with fiber competitors.

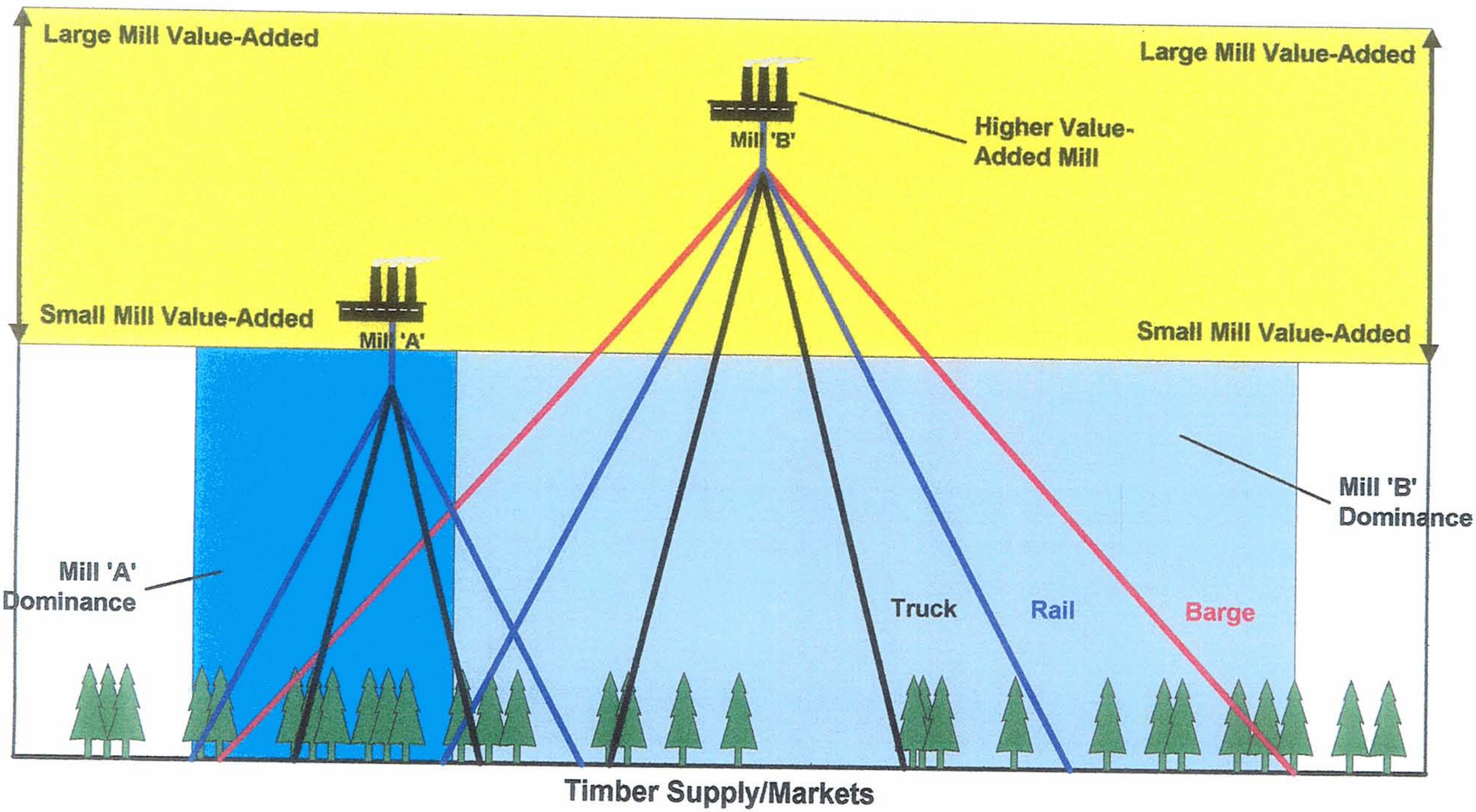
Public, vertically-integrated, U.S. forest products companies like Weyerhaeuser have disposed of most of their timberlands in recent years. About 30 million acres has changed hands since 1996. New Timberlands Management Organizations (or 'TIMO's') are the most common buyers. Rather than selling, some public companies (like Rayonier) have chosen instead to convert themselves into Real Estate Investment Trusts (or 'REIT's'). But, in order to become a REIT, a company must primarily be in the timber and land business. The tax rewards for REIT-qualifying companies are handsome- it has been reported that for every dollar of profit that Weyerhaeuser makes cutting down and converting their own trees, the company's investors earn only $.51. For every dollar of profit that Rayonier (which, of course, also makes dissolving pulp and sells logs from the timberlands it still owns on the Olympic Peninsula) makes cutting down and selling similar trees, Rayonier's investors earn $.85. It would seem equitable (and inevitable?) that Weyerhaeuser (and the few other remaining vertically-integrated public forest products companies) would eventually gain tax parity but another, more serious trend also seems to be at work here. Driven to enhance shareholder value, public forest products companies aren't just selling timberlands. They are becoming less integrated and more market responsive at every stage of their value chains. The importance of this trend to a new Cosmopolis mill owner is obvious- open markets will very likely guide the future allocation of Weyerhaeuser timber and chips.

The Grays Harbor area has had such a surplus of whitewood logs that our company began transporting hemlock and spruce logs from the area, via railcars, to Southern Oregon, Idaho and California sawmills and veneer mills in the late 1990's. We still do so today but the volume has dropped considerably due to the construction of new, nearby sawmills and (most recently) to much higher rail rates and declining wood products prices.

Pacific Northwest Hemlock Fiber Procurement Basics

A mill's success in fiber procurement in the Pacific Northwest is a function of the mill's fiber procurement strategy and its execution. The exhibit on the following page gives an overview of the factors that constrain such a strategy. Along the bottom of the page is the geographic distribution of fiber that meets the mill's fiber quality requirements. As can be seen, the distribution of this fiber (illustrated by the 'trees') is not uniform. Some areas contain more fiber, other areas contain less. Companies attempt to locate mills in areas where the required fiber is relatively abundant but, over time, this situation tends to change. Uncompetitive mills may go out of business or an insect infestation may occur (like the current mountain pine beetle epidemic currently underway in the interior of BC) thereby creating areas with relatively more or less abundant fiber supplies.

Mill Fiber Procurement Economics



High logging costs (as in BC), high transportation costs and the closure of uncompetitive sawmills may also diminish the supply of economically accessible fiber.

A mill's ability to compete for this distribution of economic fiber is a function of the mill's non-fiber economic value-added (in a nutshell, a more profitable mill can afford to pay more for wood than a less profitable mill can). This is illustrated by the 'height' of the mill in the yellow shaded area; Mill B is higher in the yellow box because it has greater non-fiber value-added. Another key determinant of a mill's ability to compete for fiber is the transportation options available to the mill. These options are illustrated by the colored lines emanating from the 'mills' to the 'trees'. The black lines are rather steep to illustrate higher variable cost trucking. The blue lines are less steep, illustrating lower variable cost railing costs. And the red lines have even less slope, illustrating the lowest variable cost transportation mode, barging. Current variable transportation costs are shown in the following table.

Transportation Mode	Variable Costs
Truck	$.215/BDT/One Way Mile Haul
'Class 1' Rail	$.125/BDT/One Way Mile Haul
'Shortline' Rail	$.105/BDT/One Way Mile Haul
Barging (4,000 BDT Barge)	$.075/BDT/One Way Haul Mile
Barging (8,000 BDT Barge)	$.065/BDT/One Way Haul Mile

Five things are worth noting about the figures from this table: 1) Trucking costs are substantially higher than rail or barging costs. With higher and higher fuel prices, this variable cost spread has recently grown quite large. In fact, many mills are arguably overly-dependent upon trucking now, the most flexible form of transportation. This is because fuel price increases were very modest for many years and trucking rates tended to decline after surface transportation (truck and rail) rates were deregulated around 1980. 2) These trucking costs are the costs for Washington state truckers. In BC, for instance, where truckers are permitted to haul much larger payloads, variable trucking costs are lower. 3) While barging and railing are less costly, neither barges nor railcars can obviously go everywhere. Note in our example that 'Mill A' doesn't even have access to barge. This is not uncommon. The Cosmopolis mill currently lacks direct access to either rail or barges. Furthermore, the fixed costs associated with staging, loading, unloading and, in many cases, re-hauling and truck delivering fiber that is transported by rail or barge are often quite substantial. 4) Class 1 rail rates, rates for the two large western railroads- the Union Pacific and the BNSF- are rates for relatively long hauls and, in some cases, the railroads will price even higher than these estimates to discourage incremental business. Both railroads are very busy with rapidly growing intermodal (incoming containers, predominantly from China) and coal demand and, since there are only two class 1 railroads and (as we previously discussed) competitive trucking rates are up substantially because of higher fuel costs, both class 1's are exercising their considerable pricing power and are driving up western rail rates sharply. 5) Variable barging costs, especially for the largest barges, are very modest. This means that it costs very little more, variably, to barge from the north coast of BC to Longview, Wa or even Arcata, Ca than it does to barge to the 'nearby' Port Alice BC mill. For example, it costs about $20/BDT to barge pulpwood to Port Alice and only about $30/BDT to barge all the way down and up the Columbia River to Longview.

As complicated as this simple exhibit is, it still over-simplifies the actual fiber procurement competitive environment. Mills don't totally dominate fiber procurement areas, as shown, because of fiber procurement 'price discrimination' strategies. What does this mean? In the economist's 'perfectly competitive' world, the 'rule of one price' prevails. Every fiber supplier, in this somewhat hypothetical world, knows what every other fiber supplier is being paid- on a delivered-to-the-mill basis- and demands and receives the same price. In actuality, mills often buy wood at a great distance at a greater cost because the same mill's local suppliers, who have a much better idea of what each other are being paid, have no way of knowing what the delivered cost of this fiber is. And the marginal cost of this fiber- the additional cost of this fiber over that paid to local fiber suppliers- is often les than the marginal cost of additional, locally-sourced fiber when the marginal cost of the spread of this information to local fiber suppliers is factored in.

A vertically-integrated company like Weyerhaeuser, a company that makes most resource allocation decisions with command-and-control mechanisms (versus the market-based mechanisms illustrated in the previous discussion), typically has numerous opportunities to improve its fiber procurement strategy, execution and fiber costs/quality. The tables below lists some of these apparent new opportunities:

Transportation Mode/s	Apparent Hemlock Fiber Opportunity	Keys to Execution
Truck	SPI has built a new, local sawmill and intends to build another, buys timber sales, 'partner' with SPI re: residual chips and pulpwood (250,000 BDT opportunity?)	Convince SPI of the merits of such an agreement, pay a 'fair' price, 'partner'
Truck	'Short stop' hemlock fiber from north of Hoquiam on the Olympic Peninsula (175,000 BDT's hemlock pulpwood?, 150,000 BDT's residual hemlock chips?)	'Tough out' Weyco's future efforts to try to dominate, price discriminate, superior fiber buyer skills, tighten focus on whole tree chipping
Truck	Weyerhaeuser's Aberdeen small log sawmill seems unlikely to survive on DF ($80/GT C-N-S) versus Hemlock C-N-S ($40/GT), 'partner' with successor, 150,000 BDT opportunity?	Kilns at pulpmill utilizing surplus steam?, helping shape the succession in local sawmill ownership?
Barge & Trade	Compete for plentiful, high grade 'Pulpwood" from the north coast of BC, deliver to Longview (Rainier), sort and chip, trade Weyco for Cosmopolis area fiber (200, 000 BDT opportunity/)	1) Grade log market (RFP?) 2) Barging, Teevins, chipping and short haul rail Agreements 3) Weyco Longview chip trade agreement

Transportation Mode/s	Apparent Hemlock Fiber Opportunity	Keys to Execution
Barge & Trade	Compete for very plentiful Interior BC SPF residual chips (maybe even buy from Weyco?), barge to Longview (Rainier), trade for Cosmopolis area fiber (400,000 BDT opportunity?)	1) Mission, BC 'Western' chip barge loading facility? 2) Barging, Teevins, chipping and truck haul agreements 3) Weyco Longview chip trade agreement
Short Haul Rail	'Partner' with new Centralia Sawmills mill once it has kilns, load hemlock C-N-S in Aberdeen, rail to Centralia, trade for hemlock chips back (150,000 BDT opportunity?)	1) Centralia Sawmills survives lumber market shakeout, kilns 2) Current chip supply agreement expires 3) Reasonable rail rates, service
Short Haul Rail	Buy and load hemlock pulpwood aboard railcars at Belfair, Wa (30,000 BDT opportunity?)	1) Rail loading operation 2) Reasonable rail rates
Short Haul Rail	Trade Weyerhaeuser chips purchased from suppliers on the CORP at Longview for Cosmopolis area fiber (400,000 BDT opportunity?)	1) Chip unloading, transferring at Rainier (Teevins) 2) Chip hopper supply 3) Chip purchase agreements
Short Haul Rail, Truck	Trade Simpson DF chips FOB Tacoma (via PS&P and Tacoma Rail) for Mill 5 hemlock truck chips (100,000 BDT opportunity?)	1) 'Local' agreement? 2) Simpson agreement 3) Rail agreements

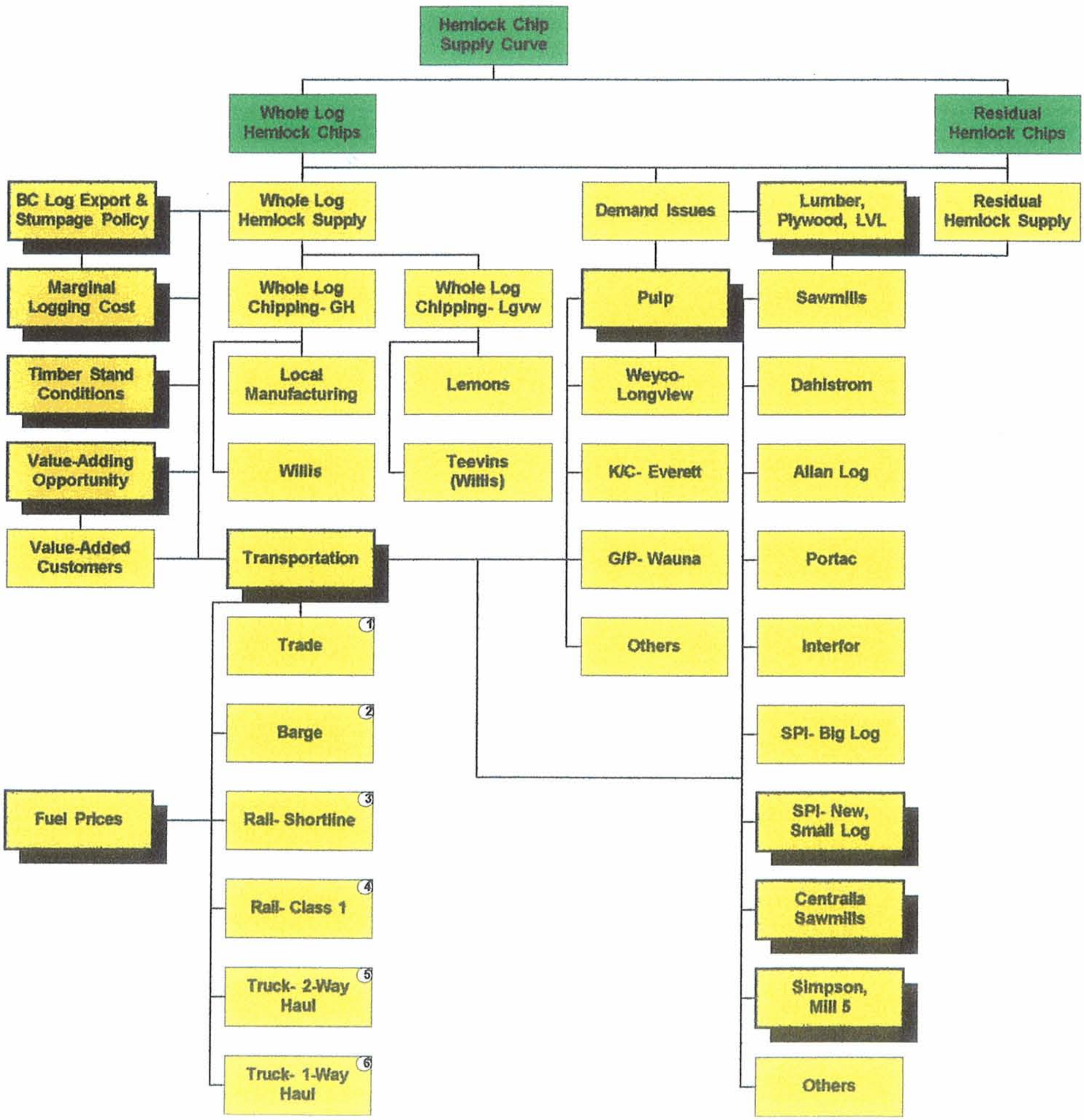
Transportation Mode/s	Apparent Hemlock Fiber Opportunity	Keys to Execution
Barge and Truck	Mill Site Chip Plant and Barge Unloading? With barge fiber, ($1,000,000/year+ cost opportunity?)	1) Versus Local? 2) Permits? Time?
Truck	Alternative species for viscose grades- alder and DF less costly in local, truck proximate area	1) Mill capability? 2) Suitable viscose grades?
Barge	Load Hemlock (Interfor?) Chip Barges at K-Ply (Port Angeles) and Barge to Mill Site? (100,000 BDT Opportunity?)	1) Mill site barge handling? 2) K-Ply and Interfor agreements?

While it is impossible to fully predict what the costs of fiber to Cosmopolis would be with full or partial success with each of these strategic sourcing options, the review team is confident that a fiber mix of 100% hemlock for acetate grades and 20% alder and 80% hemlock for viscose grades could be procured in the future for $86/BDT- hemlock and $76/BDT-alder. (See 'Financials' section)

The new hemlock fiber opportunities listed in these tables are far from exhaustive and they are offered only to give a sampling of what a new mill buyer might conceivably do to 'wood' the Cosmopolis mill. Further information on these and other opportunities is available from the Paneltech review team (see Roy Nott). Furthermore, a flowchart at the end of this section more completely details the mill's fiber cost drivers.

The key conclusions to this point in our discussion of fiber procurement are: 1) The Cosmopolis mill is largely dependent upon a specific type of fiber (hemlock) which it is well-located to economically access by three transportation modes- truck, short haul rail and barge. 2) Weyerhaeuser's chosen form of organization- primarily vertical integration- has likely lessened its involvement in and sensitivity to many potential open market hemlock fiber procurement opportunities. 3) There appear to be several viable economic opportunities to more economically replace the fiber Weyerhaeuser says its intends to route from the Cosmopolis mill area to Longview in the future. Unfortunately, these opportunities to trade fiber with Weyerhaeuser in the future may also be hampered by the company's current form of organization and decision making.

Cosmopolis Hemlock Chip Cost Drivers



COMPETITIVENESS

Competitive Analysis

Acetate (see Graph 1)

The most recent Weyerhaeuser competitive analysis is apparently from 1999. The conclusions from that analysis might be considered suspect because:

1. The second lowest cost acetate producer, according to the study, was International Paper Company's Natchez, Mississippi PHK mill and it subsequently closed.

2. The Port Alice mill, a mill with an indicated lower production cost than Cosmopolis, closed twice since then for lack of profitability and has only recently restarted with new owners, new government assistance and reportedly with significant workforce compensation reductions.

3. The Cosmopolis mill gained significant marketshare in acetate through the period 1999 to 2005.

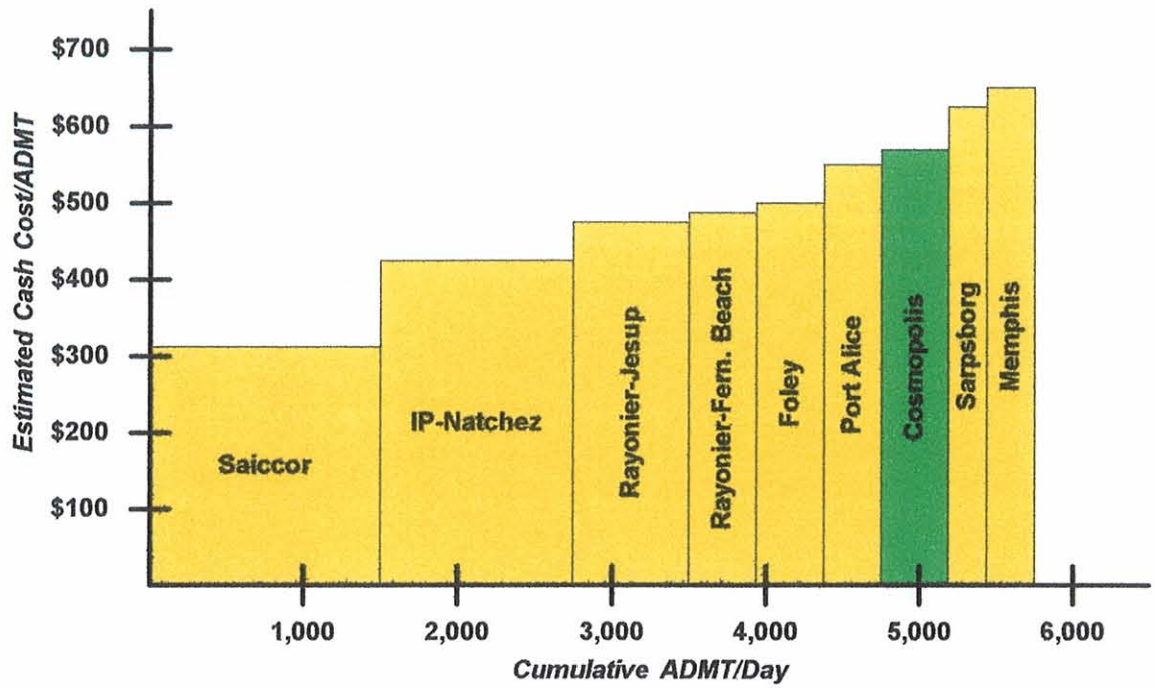
Possible explanations for these apparent anomalies:

1. The Cosmopolis mill invested heavily in automation during this time period and focused more intently on grade mix simplification. Total mill staffing was reduced from about 310 to about 235 people, with what is likely a $30-40/ADMT reduction in costs.

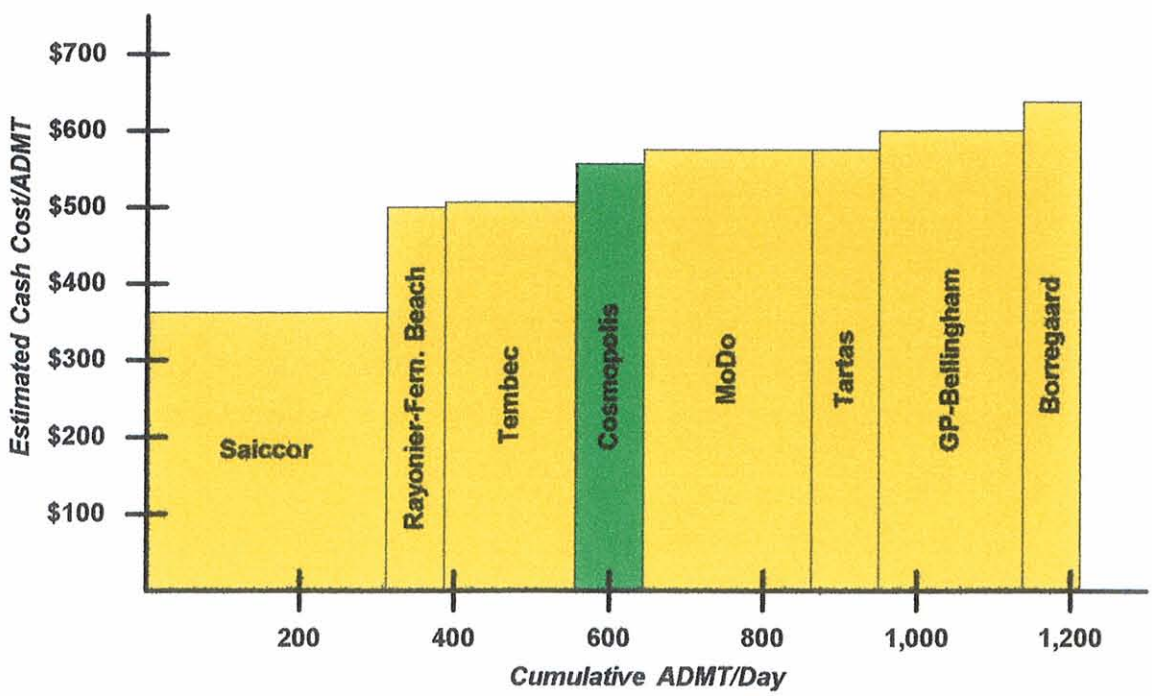
2. European currencies strengthened against the dollar adding, according to Weyerhaeuser, about $70/ADMT to a European producer's cash costs to produce (paper-grade kraft) pulp relative to US producers.

3. Eastern Canadian producers have also been handicapped by their strengthening currency- to the tune of about $50/ADMT. Also, serious wood issues have surfaced in this area.

Graph 1
Acetate Cash Production Cost Estimates
1999.1



Graph 2
Molding Cash Production Cost Estimates
1999.3



4. Obviously, Western Canadian producers have also been impacted by the strengthening 'loony' (Canadian Dollar).

5. Southern U.S. pulp producers must increasingly compete with new, more productive and (recently) far more profitable OSB producers for their softwood and hardwood fiber supplies. More stringent harvesting restrictions and increased demand have especially (as mentioned in the executive summary) impacted hardwood fiber costs.

6. Saiccor does not appear to have gained much of a position in acetate, possibly because of significant quality and processing issues.

<u>Ethers and Molding Compounds (see Graph 2)</u>

With the exception of Saiccor, this 1999 chart is pretty flat. One would think that the weakening of the U.S. currency, the shutdown of the competitive GP-Bellingham, Wa mill and the improvements in the Cosmopolis mill's relative cost position would offer attractive opportunities in these markets for the mill. It may simply be a globally over-supplied market. Saiccor does not seem to have the high brightness capabilities nor the interest in the top end of the molding compound market.

<u>Methodology for Competitive Analysis</u>

I. Weyerhaeuser Data Base

- Start with published literature for total tons per day.
- Run a backward fiber balance to the wood source.
- Consider the type of process and number of lines.
- Quarterly update of regional fiber costs.
- Add mill specific species/chip/round wood knowledge.
- Use an energy balance based on mill type and age.
- Consider hog boiler contribution from wood supply.
- Make up with fossil fuel and regional fuel costs.
- Consider turbine generator capability.
- Chemical use depends on mill type and bleach sequence.
- Model is not refined for P11K so bleaching costs were increased.
- No byproduct credit for 1000/c hardwood.
- Labor, salary, and material costs driven from people counts.

II. Refine the above

- Trip reports, current literature
- Pulp and Paper on line
- Dow Jones news search
- New capital survey
- New capacity survey

III. Assumptions for a PHK mill

- Southern mill on 100% hardwood
- Acetate production
- Batch digesters
- Cold caustic extraction

Updated Truman Seely Grade Cost Comparisons (May 7, 2006)

After our project team's meeting on the May 5, 2006, Truman volunteered to provide his best shot at the current manufacturing cost for viscose staple pulp at Cosmopolis. This arose from the apparent need to fill the mill schedule, and the assumption that viscose staple might be the best, short- term way to do it. In order to keep things consistent, Truman tried to stay with the same basic assumptions used to create the acetate grade cost. Once he got started, it occurred to him that a little more information on the same basis might be worthwhile, so he also worked up a cost for the molding compound product and for fluff or tissue grade. In all cases he assumed a flat wood cost, \$80/BDT. We need to keep in mind however that the viscose grade could be designed to include as much as 30% hardwood and the molding compound grade can use Douglas fir blended with hemlock up to the mill tolerance limit (say *50%)* and on a flexible basis. Fluff could also be designed to be high in Douglas fir if desired, but hardwood is a no. Hardwood and Douglas fiber is generally less costly than hemlock fiber. A tissue grade would likely be straight hemlock. Historically, viscose was 30% alder, 70% hemlock, molding compound was 50% hemlock and 50% Douglas fir and WEYCELL was 60% hemlock and 40% Douglas fir.

Grade Cost in *$/ADMT*

	Acetate	Viscose	Molding	Fluff or Tissue
Wood	$228	$216	$200	$200
Maint.	$157	$154	$138	$138
Chemicals	$121	$93	$62	$45
Energy	$64	$63	$56	$56
Op. Labor	$86	$84	$75	$75
Salaries	$35	$35	$31	$31
Op. S&E	$21	$21	$19	$19
Total	**$712**	**$666**	**$581**	**$564**

With the exception of chemicals, these different cost estimates are a simple consequence of different yields and run rates. The yields used were: 1) for acetate, 0.35 ADMT/BDT, 2) for viscose, 0.37, 3) for molding and 4) for fluff, 0.40. Run rates were 400 ADMT/D, 410, and 450, respectively. Based upon his past experience, Truman believes that the mill's recent $4 million in annual mill capital spending and $20 million in annual maintenance spending seems excessive.

Port Alice

As mentioned previously, the mill that could represent the most direct threat to Cosmopolis is the Port Alice mill, the 'Neucel' mill located at the north end of Vancouver Island in British Columbia. Richard Bassett, Neucel's CEO has publicly committed to spend 'more than C$100 million to establish the mill as a world player in the niche market of dissolving sulphite pulp'. (***Nanaimo Daily News***, May 6, 2006) This will be an ambitious undertaking because the mill has struggled in the past, under different ownership, to utilize its existing capacity (see the Port Alice Pulp sales graphs that follow this page) and Neucel reportedly intends to both expand capacity and to move more of its product mix into higher purity, acetate grades.

Hog Fuel

The Cosmopolis mill does not just compete in the dissolving pulp market, it also competes in the fiber (see the wood fiber section) market and the hog fuel market- the market for wood waste to fire its power boilers. The mill's principle competitor for wood waste (or hog fuel) is Grays Harbor Paper Company. Grays Harbor Paper has recently committed to the installation of an additional 7.5 MW turbine generator. This will tighten the local hog fuel supply/demand balance and make the market more competitive. The competitive hog fuel supply curve follows the Port Alice pulp sales graphs in this section of the report).

Substitutability of Pulps

Another reason for the Cosmopolis mill's economic 'staying power' is substitutability. Hardwood acetate pulps produced by the larger scale PHK (or, in the case of Saiccor, the sulphite) processes have not proven to be perfect substitutes for hemlock pulps produced by the sulphite process. And efforts to convert existing sulphite mills to the production of quality acetate pulps have often proven to be time-consuming and problematic. For example, despite their repeated attempts (with the assistance of the former director of Rayonier's acetate technology and the former technical director of Saiccor), Alaska Pulp Company's Sitka, Alaska sulphite dissolving mill ultimately was unable to make and sell a significant volume of acetate pulps and the mill was eventually forced to shut down. The Port Alice mill is once again making the attempt (perhaps encouraged by Weyerhaeuser's announced intention to shut down the Cosmopolis mill) but, as the graphs near the end of this section illustrate, the Port Alice mill has also struggled with this challenge in the past. Furthermore, the Port Alice mill is dependent upon barged pulplogs (doesn't take wood chips), barging costs are relatively insensitive to distance (increasing barge wood competition), logging costs are as much as twice as costly in B.C. as they are in Western Washington (most pulplogs are currently left 'in the bush' in B.C.) and some wood species in Northern B.C. have known acetate pulp quality problems.

Pulp Transportation Costs

Domestic, ground transportation costs in the United States have climbed sharply in recent years as fuel prices have escalated rapidly and as the few remaining, large 'class 1' railroads have exercised their growing pricing power. Container rates to Asia have remained reasonable, however, and, with the planned expansion in the number of larger, higher capacity, 'post-Panamax' (too big for the Panama Canal) container ships, some shipping industry pundits have even suggested that the container ocean rates, west-bound, could decline in the next few years. The Cosmopolis mill suffers for the lack of direct rail access but it does have nearby access to both class 1 railroads and shortline railroads and it has good access to the fastest growing Asian dissolving pulp markets.

Competitive Mills (1999 Review)

Group 1 Acetate/Dissolving

Mill	Location	Yields Barker	Screen	Digester	Bleach	Chip Yld	1999 Tons and People Total T/D	Grade T/D	Mill People	Dissolving People	1997 Properties Reference Grade	R-10	Assumed Acetate Yield	Tot Mill ADMT/Day	Grade ADMT/D
Weyerhaeuser	Cosmopolis	0.87	0.97	0.38	0.92	0.350	385	385	311	311	MAC	94.2	0.36		
Western	Port Alice	0.87	0.97	0.38	0.92	0.350	420	420	475	475	Allstaple	94.1	0.36		
Rayonier	Fernandina	0.87	0.97	0.38	0.92	0.350	430	430	349	349	Rayocord XF	94.9	0.36		
Borregaard	Sarpsborg	0.87	0.97	0.38	0.92	0.350	456	228	500	251	Future Grade		0.36		
Saiccor	Umkommas	0.90	0.98	0.38	0.92	0.350	1,520	1,520	1,270	1,270	V (Viscose)	90.2	0.36	1600	
IP	Natchez MS	0.90	0.98	0.37	0.86	0.318	1,150	1,150	779	779	Viscocell (Vis)	92.9	0.33		
Rayonier	Jesup GA	0.87	0.97	0.38	0.87	0.331	1,600	800	884	884	Sulfatate-HJ	97.7	0.33		
Buckeye Tech	Foley FL	0.87	0.97	0.38	0.87	0.331	1,279	429	850	340	Buckeye A-5	96.5	0.33		
Buckeye Tech	Memphis TN					0.750	285	285	206	206	Linter	-96	0.75	285	285

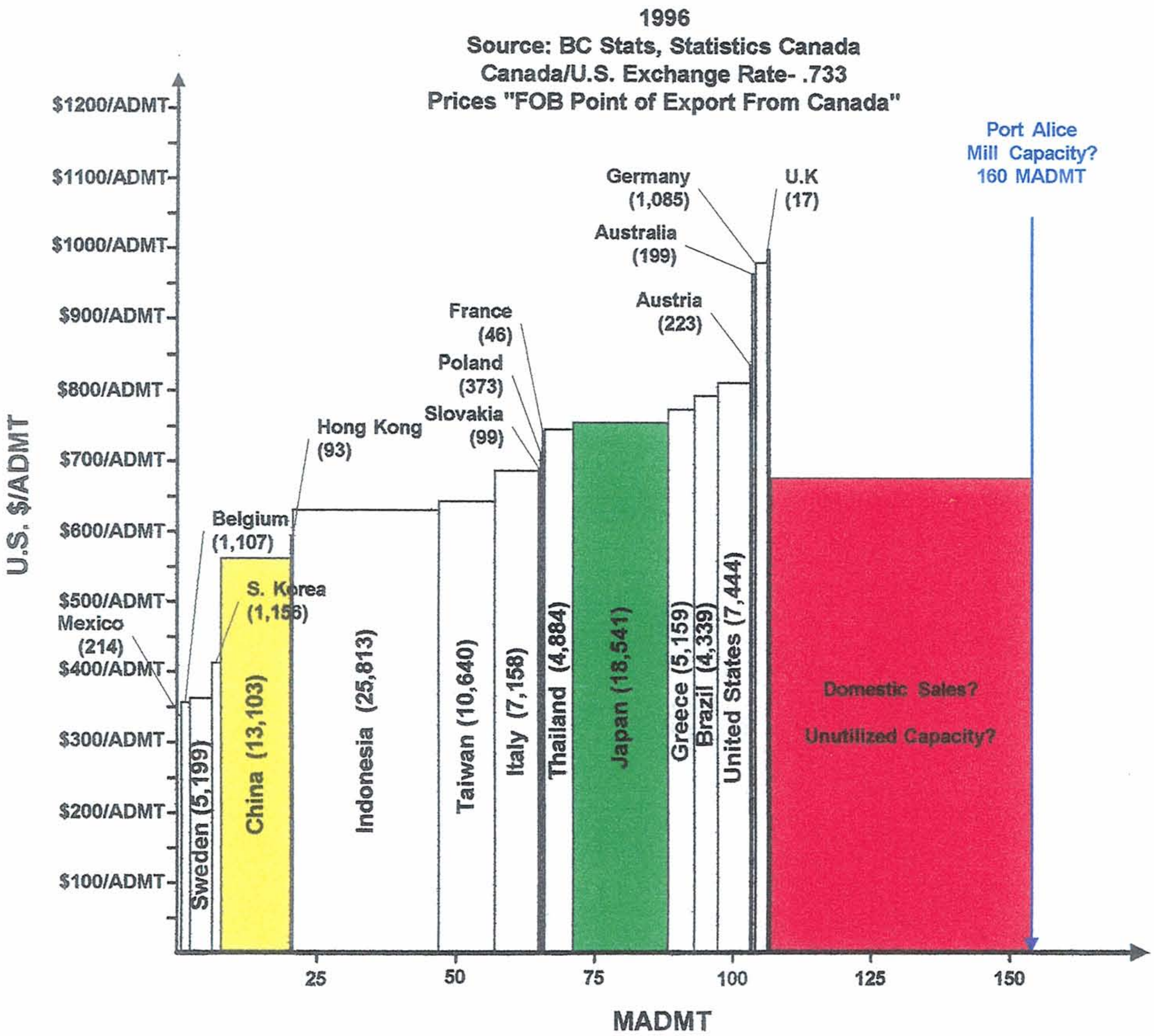
Assumption: Mills produce as much MAC acetate type pulp as they can (Whole mill or just dissolving line)

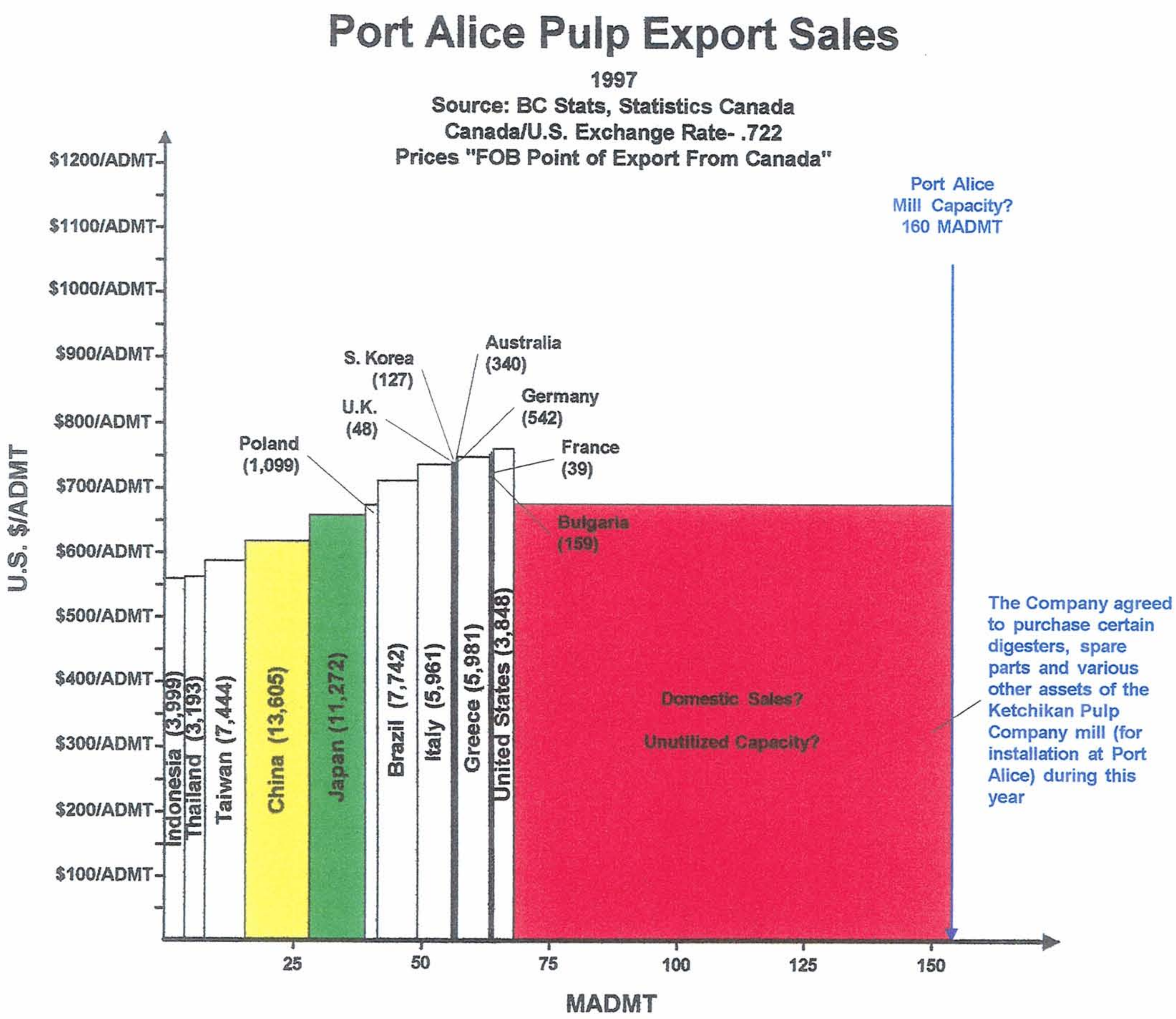
Group 2 Moulding/Photo/Ethers (NOT UPDATED IN 1999)

Mill	Location	Barker	Screen	Digester	Bleach	Chip Yld	Total T/D	Grade T/D	Mill People	Dissolving People	Reference Grade	R-10	Assumed Acetate Yield
Weyerhaeuser	Cosmopolis	0.87	0.97	0.38	0.92	0.3496	399	133	337		PH	89.8	0.42
GP	Bellingham										Puget Ultra	89.8	0.42
Borregaard	Sarpsborg	0.87	0.97	0.42	0.95	0.399	456	228	500		MC	89.8	0.42
Tembec	Temiscaming	0.87	0.97	0.42	0.95	0.399	1,180	230	910		Terrifite	87.7	0.42
Saiccor	Umkomaas						1,600	1,600	1,270		MC	91.0	0.42
MoDo	Ornskoldvik												0.42

Company Name	Mill Name	Product Subset	Mill Location-State	Location-World Region	Total Mill Production	Feber Line Output	Fiber	Chemical Cost	Electrical Cost	Total Fuel Cost	Labor	Total Material	Salary	Other	Total Cost
Saiccor PTY Ltd.	Umkomaas	Dissolving		SO AFR	1520	1520	$120.27	$81.55	$2.50	$21.28	$10.65	$56.44	$13.81	$20.00	$338.51
International Paper	Natchez	Dissolving	MS	SOUTH-2	1150	1150	$165.30	$53.90	$3.68	$14.07	$98.08	$53.55	$19.27	$10.00	$428.45
Rayonier Inc	Jesup	Dissolving	GA	SOUTH-2	1600	800	$179.14	$67.80	$7.66	$13.67	$102.67	$69.85	$20.59	$10.00	$477.08
Rayonier Inc	Fernandina Beach	Dissolving	FL	SOUTH-2	407	457	$166.49	$85.00	$8.50	$10.77	$105.09	$79.54	$25.82	$10.00	$484.30
Buckeye Technologies	Foley	Dissolving	FL	SOUTH-2	1279	429	$208.16	$50.58	$2.23	$21.90	$83.89	$86.02	$48.15	$10.00	$502.01
Western Pulp	Port Alice	Dissolving	BC	WC/CN-7	420	420	$175.92	$73.58	$0.00	$37.12	$145.18	$86.72	$35.93	$10.00	$594.40
Weyerhaeuser Co	Cosmopolis	Dissolving	WA	WEST-6	380	385	$215.41	$68.50	$14.34	$20.01	$128.48	$102.87	$30.76	$10.00	$581.35
Borregaard Industries Ltd	Sarpsborg	Dissolving		NORWAY	458	223	$255.50	$62.43	$5.46	$24.07	$168.34	$94.57	$28.32	$10.00	$633.89
Buckeye Technologies	Memphis	Dissolving	TN	SOUTH-2	285	285	$413.00	$20.00	$18.00	$30.00	$93.00	$48.00	$40.00	$10.00	$688.00

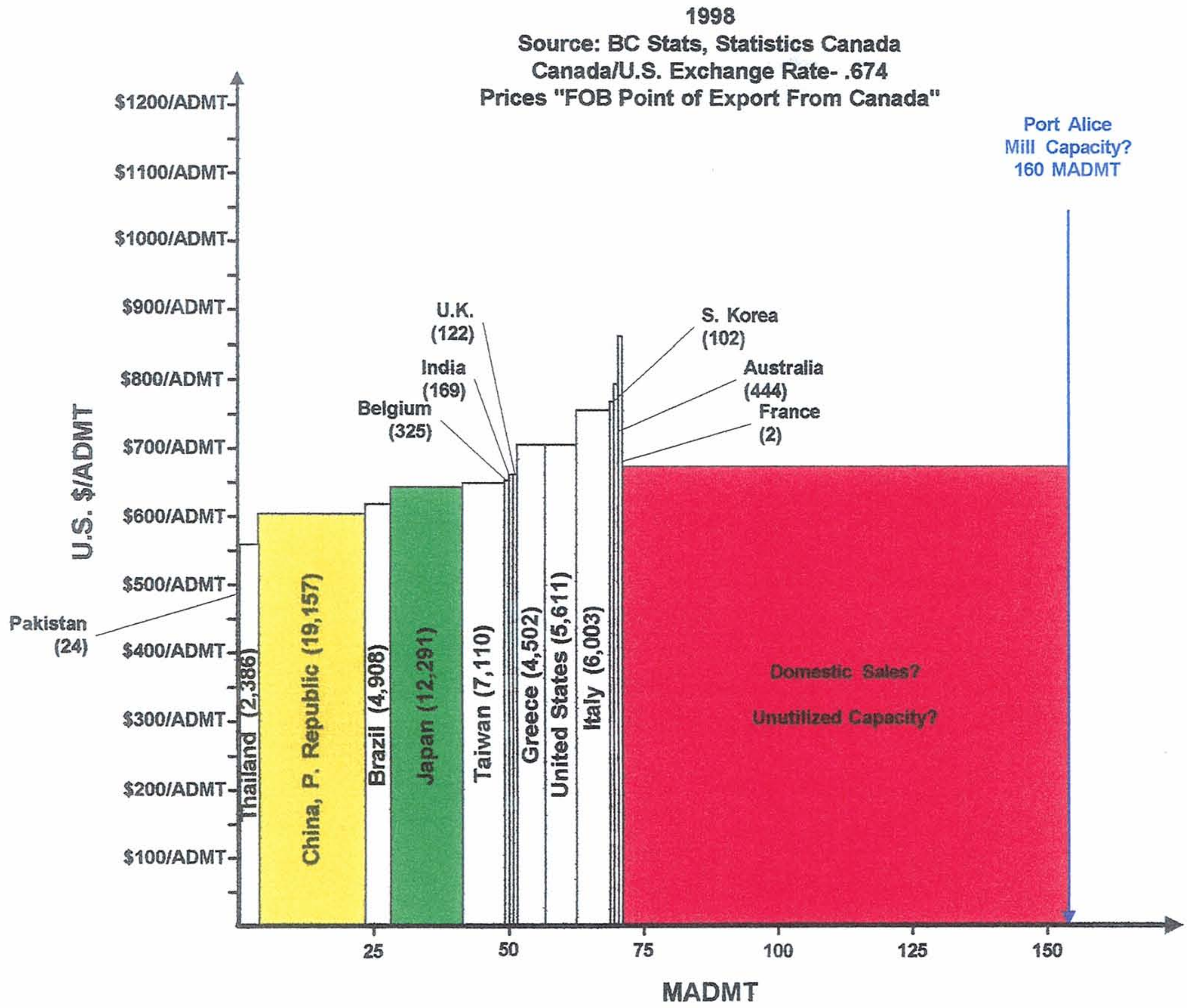
Port Alice Pulp Export Sales

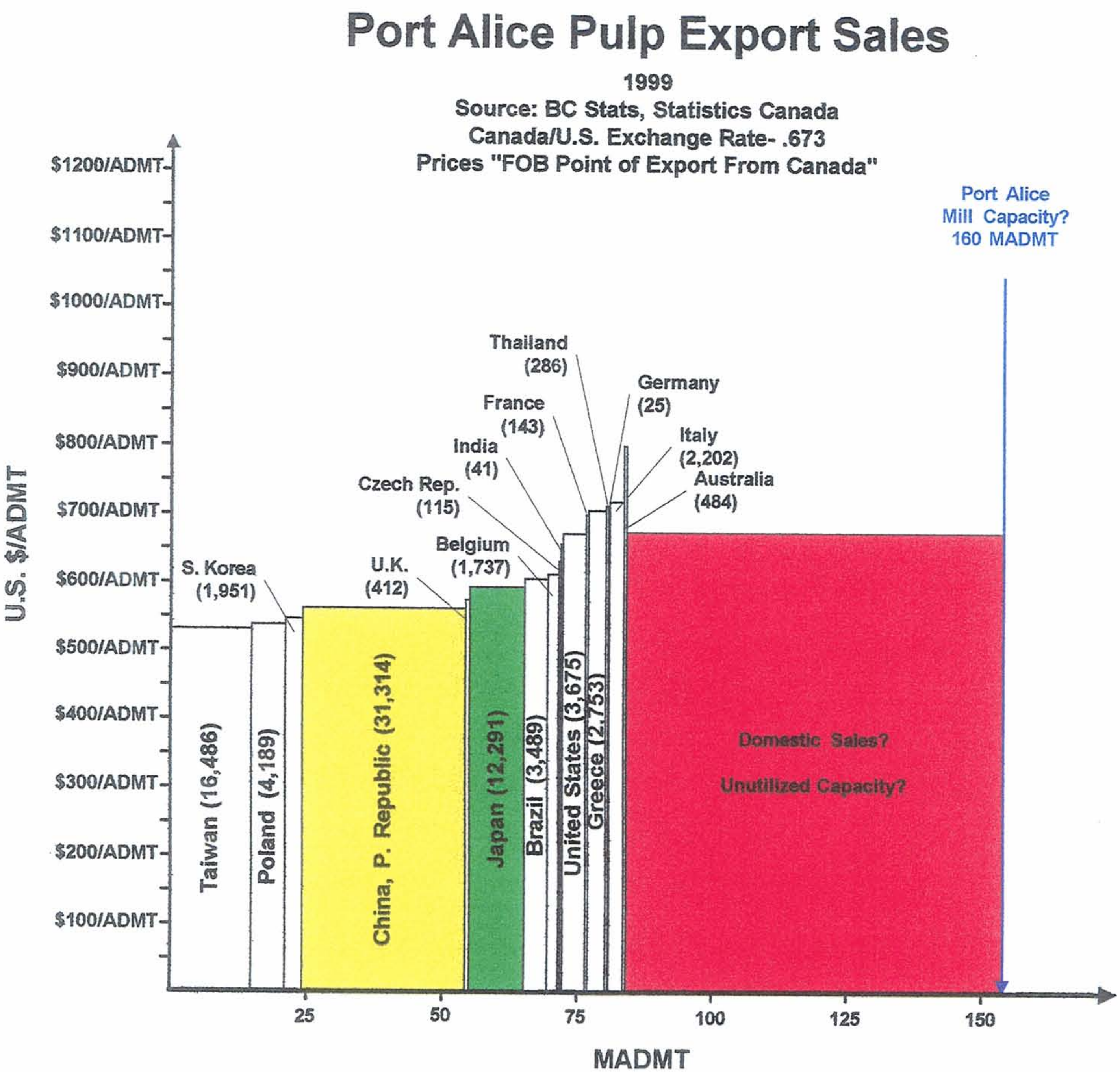




Port Alice Pulp Export Sales
1997
Source: BC Stats, Statistics Canada
Canada/U.S. Exchange Rate- .722
Prices "FOB Point of Export From Canada"
Port Alice
Mill Capacity?
160 MADMT
$1200/ADMT
$1100/ADMT
$1000/ADMT
$900/ADMT
$800/ADMT
$700/ADMT
$600/ADMT
$500/ADMT
$400/ADMT
$300/ADMT
$200/ADMT
$100/ADMT
U.S. $/ADMT
S. Korea (127)
Australia (340)
Germany (542)
U.K. (48)
Poland (1,099)
France (39)
Bulgaria (159)
Indonesia (3,999)
Thailand (3,193)
Taiwan (7,444)
China (13,605)
Japan (11,272)
Brazil (7,742)
Italy (5,961)
Greece (5,981)
United States (3,848)
Domestic Sales?
Unutilized Capacity?
The Company agreed to purchase certain digesters, spare parts and various other assets of the Ketchikan Pulp Company mill (for installation at Port Alice) during this year
25
50
75
100
125
150
MADMT

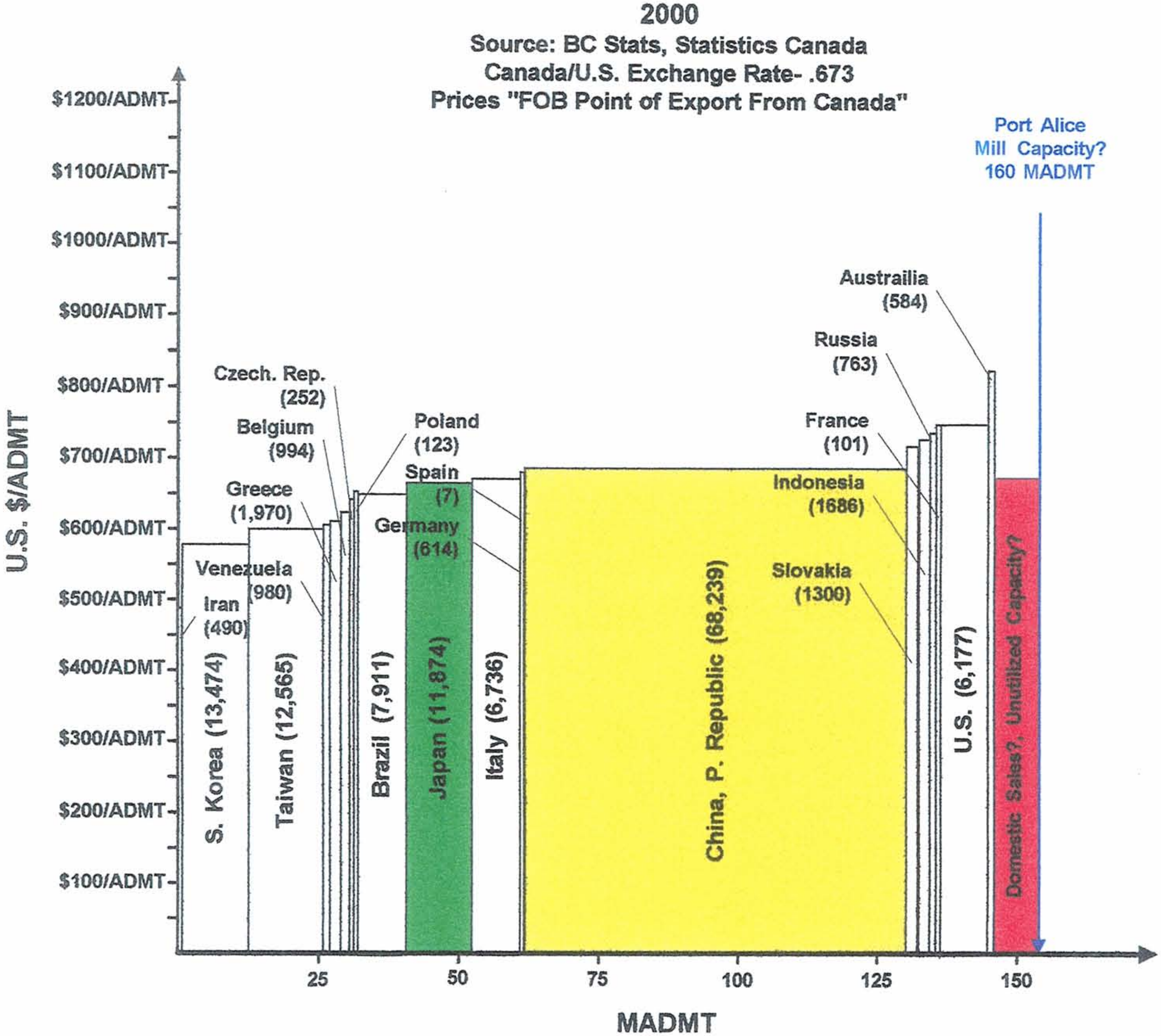
Port Alice Pulp Export Sales





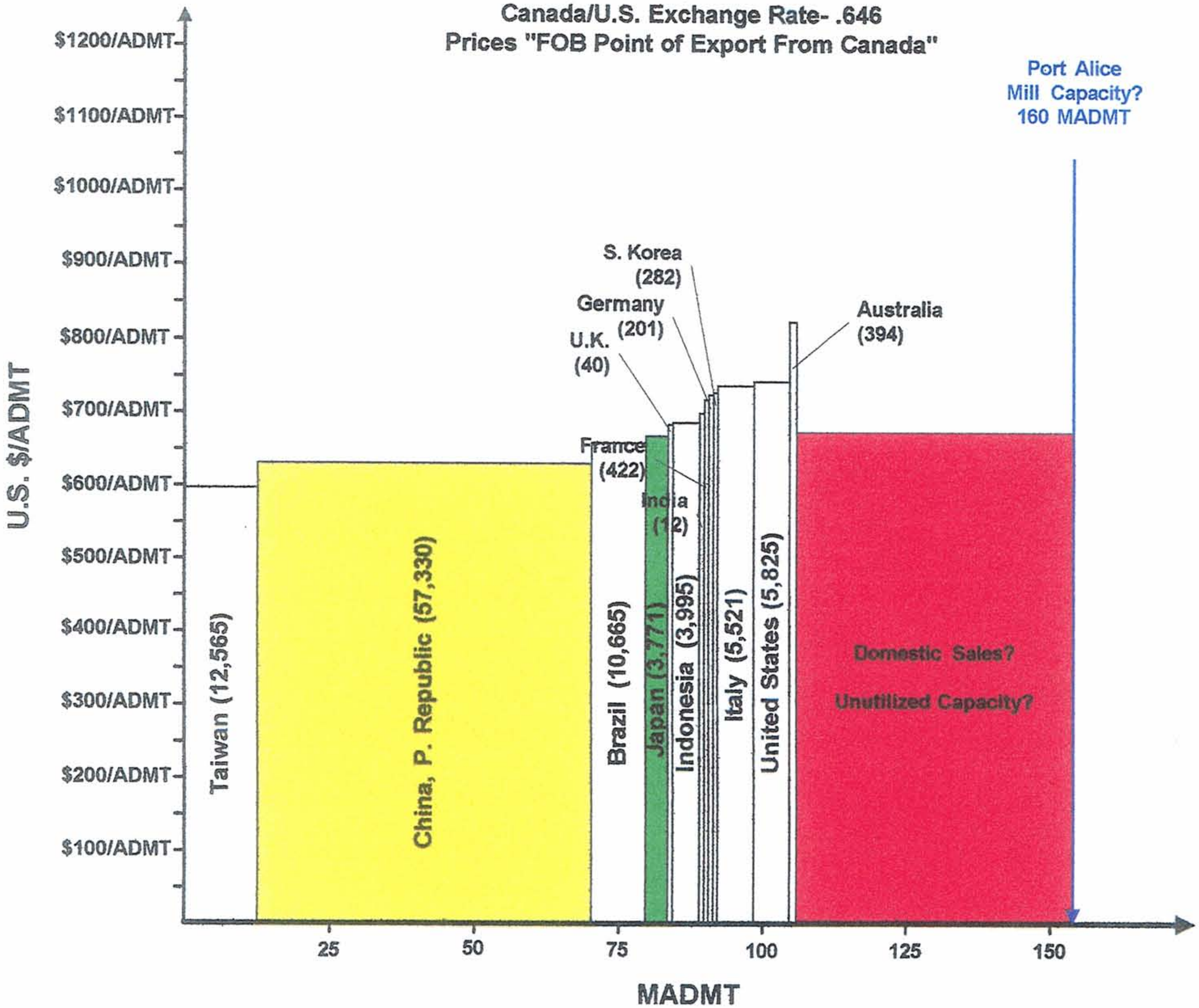
Port Alice Pulp Export Sales
1999
Source: BC Stats, Statistics Canada
Canada/U.S. Exchange Rate- .673
Prices "FOB Point of Export From Canada"
Port Alice
Mill Capacity?
160 MADMT
$1200/ADMT
$1100/ADMT
$1000/ADMT
$900/ADMT
$800/ADMT
$700/ADMT
$600/ADMT
$500/ADMT
$400/ADMT
$300/ADMT
$200/ADMT
$100/ADMT
U.S. $/ADMT
Thailand (286)
Germany (25)
France (143)
Italy (2,202)
India (41)
Australia (484)
Czech Rep. (115)
Belgium (1,737)
S. Korea (1,951)
U.K. (412)
Taiwan (16,486)
Poland (4,189)
China, P. Republic (31,314)
Japan (12,291)
Brazil (3,489)
United States (3,675)
Greece (2,753)
Domestic Sales?
Unutilized Capacity?
25
50
75
100
125
150
MADMT

Port Alice Pulp Export Sales

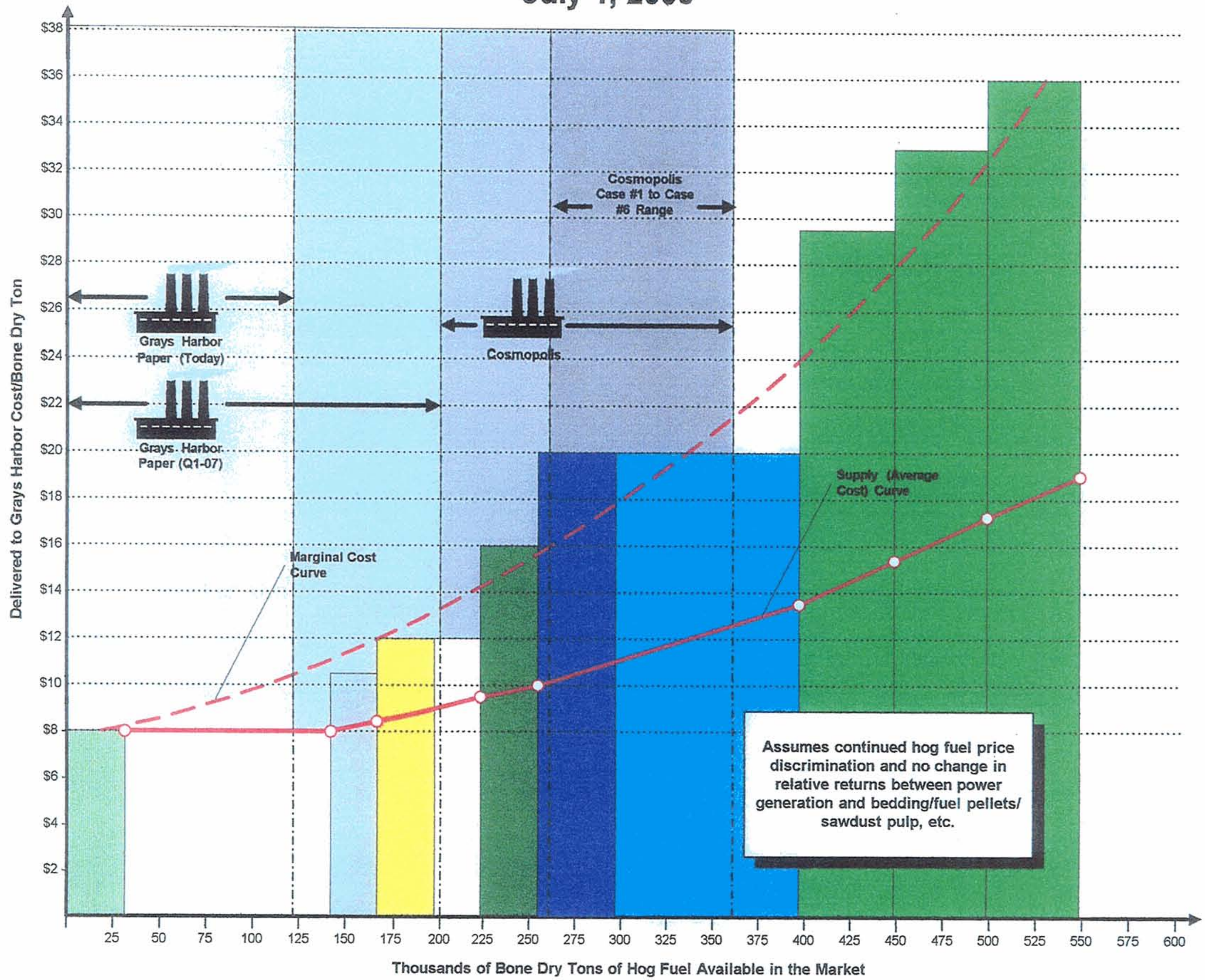


Port Alice Pulp Export Sales

2001
Source: BC Stats, Statistics Canada
Canada/U.S. Exchange Rate- .646
Prices "FOB Point of Export From Canada"



Estimated Grays Harbor Area Hog Fuel Supply (Average Cost) Curve and Marginal Hog Fuel Cost Curve July 1, 2006



Roy Nott, June 29, 2006

ENVIRONMENTAL

LDN, 7/11/2006

Mill Environmental Status

The Cosmopolis pulpmill normally operates in compliance with existing regulations for both air emissions and water discharges. On occasion, a permit limit is exceeded but the events are rare and the causes are readily assignable.

The most persistent, ongoing problem (but, possibly, the least serious) is an occasional high level of elevated level of (fecal) coliform in the mill's water effluent. About once a year this causes the Washington Department of Health (D.O.H.) to issue a one-week closure on Grays Harbor's commercial oyster beds. It is also possible that closures of commercial shellfish harvest in Grays Harbor by D.O.H. could increase if wastewater treatment practices changed with new mill management practices and/or with new environmental staff.

The mill does face a compliance order with respect to effluent toxicity for oyster embryo survival (chronic toxicity). Mill studies were apparently in progress on this state-mandated compliance rule but no feasible solution was as yet identified when the company announced its intention to close the mill. Since sampling studies confirm no impact on naturally occurring marine bivalves in the bay, and no economically feasible solution is evident, this compliance order <u>may</u> require no action beyond the study.

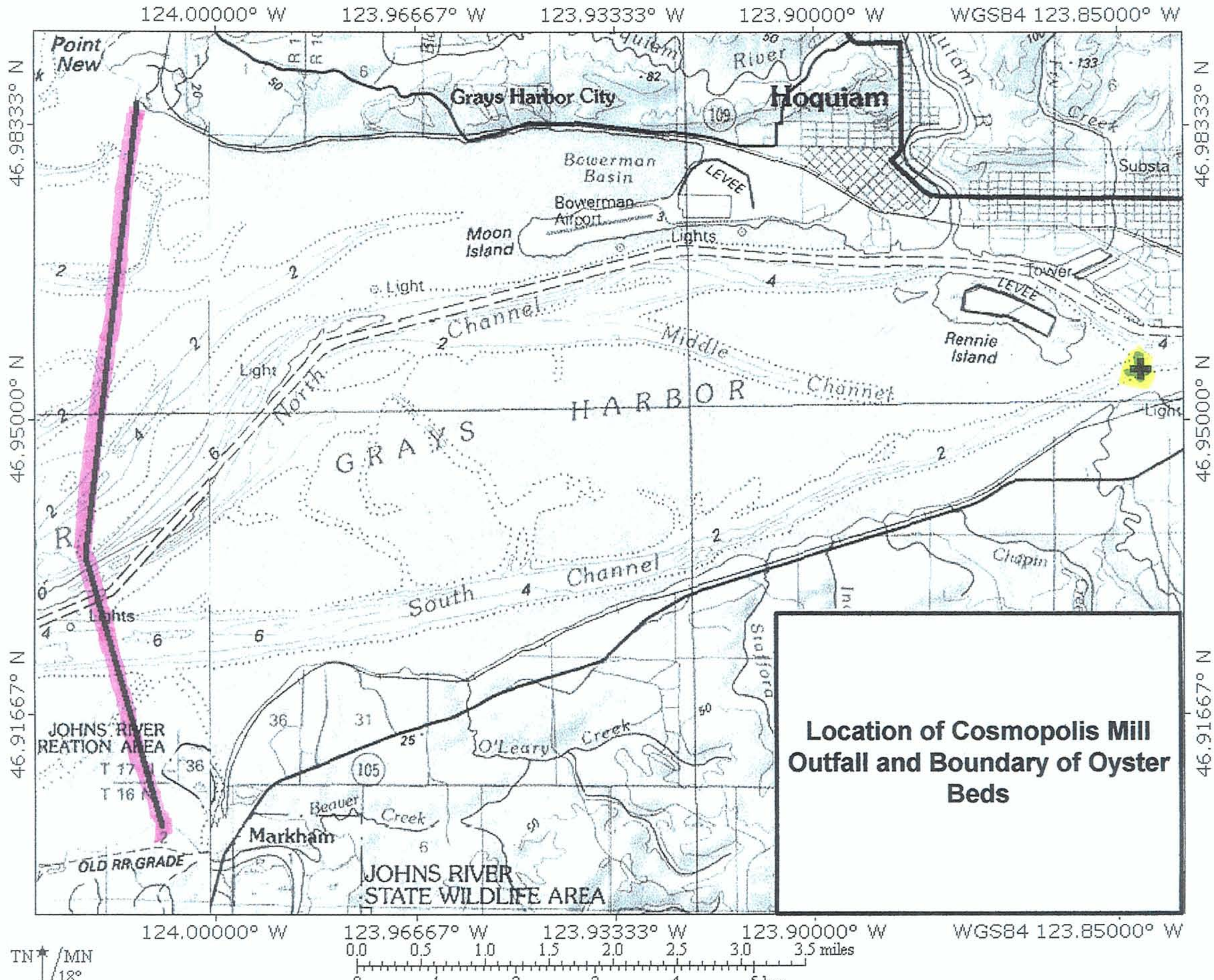
Two new regulations will soon have to be met, however. If the Cosmopolis mill operates past November 12, 2006, the mill must comply with control requirements for MACT (Maximum Achievable Control Technology) 1. The rule requires that bleach stage emissions must meet a 10ppm limit for Cl2 or 0.002 lbs Cl2/ton. Chloroform limits and some parametric continuous monitoring are elements of this rule. Mill personnel have identified two low flow gas streams (CD tower vent and #1 footbox vent) that require treatment for chlorine removal. They have estimated a cost of $100,00 to $200,000 for compliance.

The second new rule takes effect in September, 2007 and it is referred to as boiler MACT. This rule applies to the mill's power boiler only (MACT compliance for the recovery units has been resolved). There are several alternative criteria which could be met. The current system cannot meet the new 'particulate' requirements but can meet the allowable 'total select metals' criteria. The only anticipated mill process change to meet this requirement is to avoid burning the 'hog fuel (bark, etc.) from pulplogs that have been borne in salt water. The hog fuel supply curve at the end of the 'Competitiveness' section does not contain any sources that are 'contaminated' with salt water so a minimal economic impact of compliance is assumed. This salt water concern might also limit some future opportunities to buy pulplogs from sources in BC.

Clearly, at this stage, a new mill owner would wish to negotiate some relief from the MACT 1 timetable and would also wish to critically examine the bivalve embryo compliance order. There would be very little ability to change the timetable for the boiler MACT but there could be some room for flexibility with the compliance option.

The pulpmill's current federal NPDES (National Pollution Discharge Elimination System) permit is set to expire November 1, 2008 and the mill's air operating permit expires November 15, 2009. Re-issuance of these permits is a time and resource consuming process, the outcome of which is usually more restrictive and expensive compliance requirements. Normal permit periods are five years.

For further questions regarding the shellfish harvest closures attributed to mill operations and possible future environmental health issues, we would refer the reader to Frank Meriwether, Environmental Engineer, Department of Health, Food Safety and Shellfish Program, 7171 Clearwater Lane, Building 4, P.O. Box 47824, Olympia, Washington, 98504-7824. For further questions regarding the mill's previous and prospective environmental compliance challenges, we would refer the reader to Dick Wallace, Regional Director, Southwest Regional Office, Department of Ecology, Southwest Regional Office, P.O. Box 47775, Olympia, Washington 98504-7775.



Map created with TOPO!® ©2002 National Geographic (www.nationalgeographic.com/topo)

FINANCIAL

Mill Site Environmental Liabilities

Background

Prior to the current mill's construction, the mill was the site of Grays Harbor Commercial Company. The Company was a large, spread out and diverse wood products manufacturer. Undoubtedly this operation had some impact on the underlying soils which may or may not still be detectable.

The present mill had on site two landfills, one for construction debris and one for woodwaste (knots and tailings). Both sites were closed by 1990, following Washington State Department of Ecology (DOE) procedures. The closures were, at that time, deemed complete by the DOE.

The secondary treatment system for selected mill affluent streams covers several acres. The holding and aeration lagoons in this system lack impervious linings so some exchange with ground and surface waters has occurred (and continues to occur). No negative consequences are known.

Minor but persistent losses of sodium hydroxide associated with the unloading process has rendered a small portion of the site ground water alkaline. These NaOH losses were eliminated and the alkaline water withdrawn from a shallow well, and discharged with the mill effluent. This flushing is assumed to be complete by now.

A buried wood stave line carries mill effluent to the discharge area some three miles from the mill proper. On rare occasion, this line has leaked and repairs have had to be made. No environmental consequences are known or anticipated, however leaks from this line could hinder further operations.

The outfall area itself includes holding lagoons and a still open landfill. The latter contains primary and secondary solids accumulated since mill operations began in 1957. The fill has not been used for about 10 years. The material has all of the chemical compounds one might expect to find from a sulphite dissolving mill of this sort. Also, since the amount of secondary solids is quite high relative to primary solids, the surface in uncompacted. A method of "vegetative closure" is currently in progress.

Monitoring wells near the spoils areas and storage lagoons do indicate some ground water exchange. Groundwater in the area is brackish and not used domestically. Both the DOE and Weyerhaeuser have apparently felt the situation to be acceptable.

Notes Regarding the Pro-forma Financial Statement

A Pro-forma Financial Statement is enclosed reporting "what if" results for the five years 2006-2010. The basis for the report includes historical data from Weyerhaeuser, our own expert estimates and market assumptions, and research into industry data.

Although Weyerhaeuser provided summary information for 2005, they did not provide any detail of pulp grades including sales, production, costs, etc. In 2005 and 2006, Cosmopolis produced nearly all acetate grades. In the pro-forma, 2006 is restated to be "what if" Cosmopolis was being run all year as a going concern. Looking forward, it is assumed that Cosmopolis would produce different grades as well. It is believed the acetate opportunities for Cosmopolis will shrink in 2007 and there will not be enough acetate demand to consume the mills capacity. It is not considered feasible to operate the plant significantly below capacity.

This is important because Cosmopolis has been profitable in the past, manufacturing primarily acetate grades. Other grades, which have larger market opportunities, have lower value and negative returns to Cosmopolis. However, in order to fill the capacity, grades which have larger markets, primarily viscose, were added to the pro-forma.

In the past 4 years, Cosmopolis produced 135,000 ADMT average per year. The pro-forma assumes this production level for all years. The marketing section of this report does not predict 135,000 ADMT of sales. For the pro-forma, we added additional viscose grade sales to total 135,000 ADMT. This caused the mix of negative margin products (viscose) to increase relative to the volume of higher margin products (acetate), driving the pro-forma pre-tax cash results for future years down.

Pro-forma pre-tax cash results by year:

2006	$7,481 million	Acetate 84% of total ADMT
2007	($1,163)	Acetate 54%
2008	$536	Acetate 66%
2009	$679	Acetate 66%
2010	$6,476	Acetate 72%

The marketing section of this report describes an optimistic case and a pessimistic case. This pro-forma is based on the optimistic case. The difference between the two, impacting both price and volume, is more pronounced in the years 2008-2010. The pre-tax cash difference between the optimistic and pessimistic cases combined for all years is $17.7 million.

Sales freight, discounts and commissions are estimated in the marketing section. Certain North American customers are served by rail. Cosmopolis has no rail service. Costs were included for the transload of trucks to boxcars by local vendors.

The sourcing plan for wood chips included in the model is discussed in a separate section. Wood furnish for all grades is assumed to be 100% hemlock except viscose which is assumed to be 20% alder and 80% hemlock. The purchase price in the pro-forma is $86/bdt for hemlock and $76/bdt for alder. The amount of wood consumed for a given amount of finished pulp produced (yield) was estimated by our expert. The wood cost in the pro-forma is about $240 per ADMT. This value is higher than Weyerhaeuser's actual 2005 and 2006 YTD values of $189 and $213. Weyerhaeuser did not provide actual yield or chip cost information for comparison purposes.

Manufacturing costs by grade were estimated by our expert. These were compared to manufacturing costs for 2005 by major element, which were provided by Weyerhaeuser. Due to the lack of detail provided by grade and cost element, we could only compare total costs for reasonableness. As originally estimated, the total pro-forma cost appeared too high. Further industry information about energy costs resulted in lowering our estimate but the pro-forma costs appear to remain conservative.

Administrative support functions including IS, Accounting, Personnel, and Marketing were given by Weyerhaeuser to cost about $3.8 million in 2005. Weyerhaeuser did not provide detail to support this value. We separately valued these services at slightly more than $1 million per year.

Weyerhaeuser gave a capital spending average over the last 9 years at $4 mm per year. During the mill tour, many improvements had been seen in the mill and this level of capital spending should not be necessary if no improvements are made. If improvements are to be made in the future, logically there would be a corresponding cost reduction. Since no cost reduction is included in the pro-forma, historical capital spending was reduced by 50% to represent an estimate of only maintenance capital.

Property tax and insurance were estimated using outside sources. The insurance cost estimate includes a $1 mm pollution policy to protect Weyerhaeuser in addition to a new owner.

Cosmopolis Pulp Mill

Pro-forma Financial Statement

	2005 Act	2006	2007	2008	2009	2010
		Economic Assumption = weak USD, problems at Pt Alice and Bacell				
Sales - Net						
ADMT	132,860	135,000	135,000	135,000	135,000	135,000
$/ADMT	$ 823.35	$ 866.59	$ 783.03	$ 801.85	$ 803.11	$ 849.18
$000's	$ 109,390	$ 116,989	$ 105,709	$ 108,250	$ 108,419	$ 114,639
Production ADMT	140,593	135,000	135,000	135,000	135,000	135,000
Manufacturing Costs						
Wood	$ 26,600	$ 32,731	$ 31,883	$ 32,182	$ 32,192	$ 32,341
Chemicals	$ 17,090	$ 15,623	$ 14,275	$ 14,723	$ 14,737	$ 14,961
Packaging	$ 450	$ 483	$ 483	$ 483	$ 483	$ 483
Maintenance	$ 22,560	$ 21,068	$ 20,848	$ 20,896	$ 20,897	$ 20,921
Energy	$ 5,500	$ 7,241	$ 7,158	$ 7,174	$ 7,174	$ 7,182
Wages	$ 12,160	$ 11,532	$ 11,395	$ 11,427	$ 11,428	$ 11,444
Salaries	$ 5,130	$ 5,200	$ 5,200	$ 5,200	$ 5,200	$ 5,200
Other	$ 9,020	$ 11,000	$ 11,000	$ 11,000	$ 11,000	$ 11,000
Invty (Inc) Dec	$ (6,060)					
Total Mfg	$ 92,450	$ 104,878	$ 102,242	$ 103,085	$ 103,111	$ 103,532
% of sales	85%	90%	97%	95%	95%	90%
Manufacturing Margin	$ 16,940	$ 12,111	$ 3,467	$ 5,166	$ 5,309	$ 11,106
% of sales	15%	10%	3%	5%	5%	10%
Other Costs						
G&A	$ 3,810	$ 1,035	$ 1,035	$ 1,035	$ 1,035	$ 1,035
Capital Spending (Depr in 05)	$ 8,540	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000
Property Tax	$ 770	$ 385	$ 385	$ 385	$ 385	$ 385
Insurance	$ 1,800	$ 1,210	$ 1,210	$ 1,210	$ 1,210	$ 1,210
Total Other	$ 14,920	$ 4,630	$ 4,630	$ 4,630	$ 4,630	$ 4,630
Pre-tax Cash	$ 2,020	$ 7,481	$ (1,163)	$ 536	$ 679	$ 6,476

Prepared by: SDO

7/11/2006

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Sales by Customer					
Daicel					
MACII					
ADMT	48,000	25,000	25,000	25,000	30,000
Gross Price	$ 1,025	$ 1,025	$ 1,025	$ 1,025	$ 1,050
Discount %	5%	5%	5%	5%	5%
Commission %					
Freight $/ADMT	$ 60	$ 60	$ 60	$ 60	$ 60
Net Price	$ 914	$ 914	$ 914	$ 914	$ 938
Net Sales $000's	$ 43,860	$ 22,844	$ 22,844	$ 22,844	$ 28,125
Trucell					
ADMT	7,000	7,000	8,000	8,000	10,000
Gross Price	$ 1,075	$ 1,075	$ 1,025	$ 1,025	$ 1,050
Discount %	5%	5%	5%	5%	5%
Commission %					
Freight $/ADMT	$ 60	$ 60	$ 60	$ 60	$ 60
Net Price	$ 961	$ 961	$ 914	$ 914	$ 938
Net Sales $000's	$ 6,729	$ 6,729	$ 7,310	$ 7,310	$ 9,375
Total Daicel $000's	$ 50,589	$ 29,573	$ 30,154	$ 30,154	$ 37,500
Rhodia/NA					
Weycell					
ADMT	18,000	24,000	24,000	24,000	24,000
Gross Price	$ 975	$ 975	$ 950	$ 950	$ 1,000
Discount %	3%	3%	3%	3%	3%
Commission %					
Freight $/ADMT	$ 111	$ 111	$ 111	$ 111	$ 111
Net Price	$ 835	$ 835	$ 811	$ 811	$ 859
Net Sales $000's	$ 15,026	$ 20,035	$ 19,453	$ 19,453	$ 20,617

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Voridian					
MAC					
ADMT	12,000	12,000	18,000	18,000	18,000
Gross Price	$ 1,025	$ 1,025	$ 1,025	$ 1,025	$ 1,050
Discount %	4%	4%	4%	4%	4%
Commission %					
Freight $/ADMT	$ 111	$ 111	$ 111	$ 111	$ 111
Net Price	$ 873	$ 873	$ 873	$ 873	$ 897
Net Sales $000's	$ 10,476	$ 10,476	$ 15,715	$ 15,715	$ 16,147
Trucell					
ADMT	5,000				
Gross Price	$ 1,075	$ 1,075	$ 1,025	$ 1,025	$ 1,050
Discount %	4%	4%	4%	4%	4%
Commission %					
Freight $/ADMT	$ 111	$ 111	$ 111	$ 111	$ 111
Net Price	$ 921	$ 921	$ 873	$ 873	$ 897
Net Sales $000's	$ 4,605	$ -	$ -	$ -	$ -
Total Voridian $000's	$ 15,082	$ 10,476	$ 15,715	$ 15,715	$ 16,147
Celanese/Cand.					
MAC					
ADMT	24,000				
Gross Price	$ 1,025	$ 1,025	$ 1,025	$ 1,025	$ 1,050
Discount %	4%	4%	4%	4%	4%
Commission %					
Freight $/ADMT	$ 50	$ 50	$ 50	$ 50	$ 50
Net Price	$ 934	$ 934	$ 934	$ 934	$ 958
Net Sales $000's	$ 22,416	$ -	$ -	$ -	$ -

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
CCP/Others					
PH					
ADMT	4,000	9,000	9,000	9,000	9,000
Gross Price	$ 650	$ 650	$ 650	$ 650	$ 700
Discount %		0%	0%	0%	0%
Commission %	2%	2%	2%	2%	2%
Freight $/ADMT		$ -	$ -	$ -	$ -
Net Price	$ 637	$ 637	$ 637	$ 637	$ 686
Net Sales $000's	$ 2,548	$ 5,733	$ 5,733	$ 5,733	$ 6,174
Nantong					
Weycell					
ADMT		3,000	12,000	12,000	12,000
Gross Price	$ 975	$ 975	$ 950	$ 950	$ 1,000
Discount %	4%	4%	4%	4%	4%
Commission %	2%	2%	2%	2%	2%
Freight $/ADMT		$ -	$ -	$ -	$ -
Net Price	$ 917	$ 917	$ 893	$ 893	$ 940
Net Sales $000's	$ -	$ 2,750	$ 10,716	$ 10,716	$ 11,280
FMC					
PH					
ADMT		1,000	1,000	1,000	1,000
Gross Price	$ 650	$ 650	$ 650	$ 650	$ 700
Discount %		0%	0%	0%	0%
Commission %					
Freight $/ADMT		$ -	$ -	$ -	$ -
Net Price	$ 650	$ 650	$ 650	$ 650	$ 700
Net Sales $000's	$ -	$ 650	$ 650	$ 650	$ 700

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
ASIA					
Fluff					
ADMT					
Gross Price	$ 750	$ 750	$ 750	$ 750	$ 800
Discount %		0%	0%	0%	0%
Commission %					
Freight $/ADMT		$ -	$ -	$ -	$ -
Net Price	$ 750	$ 750	$ 750	$ 750	$ 800
Net Sales $000's	$ -	$ -	$ -	$ -	$ -
Ethers					
ADMT		1,500	1,500	2,000	3,000
Gross Price	$ 1,025	$ 1,025	$ 1,025	$ 1,025	$ 1,025
Discount %		0%	0%	0%	0%
Commission %	2%	2%	2%	2%	2%
Freight $/ADMT		$ -	$ -	$ -	$ -
Net Price	$ 1,005	$ 1,005	$ 1,005	$ 1,005	$ 1,005
Net Sales $000's	$ -	$ 1,507	$ 1,507	$ 2,009	$ 3,014
ASIA					
Viscose					
ADMT	12,000	20,000	20,000	20,000	20,000
Gross Price	$ 680	$ 680	$ 680	$ 680	$ 700
Discount %		0%	0%	0%	0%
Commission %	2%	2%	2%	2%	2%
Freight $/ADMT		$ -	$ -	$ -	$ -
Net Price	$ 666	$ 666	$ 666	$ 666	$ 686
Net Sales $000's	$ 7,997	$ 13,328	$ 13,328	$ 13,328	$ 13,720
Sub-total					
ADMT	130,000	102,500	118,500	119,000	127,000
Net Price	$ 874	$ 820	$ 821	$ 821	$ 859
Net Sales $000's	$ 113,657	$ 84,051	$ 97,255	$ 97,757	$ 109,151

Cosmopolis Pulp Mill

Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Fill in to hit full production - 135,000 ADM'					
VISCOSE					
ADMT	5,000	32,500	16,500	16,000	8,000
Gross Price	$ 680	$ 680	$ 680	$ 680	$ 700
Discount %		0%	0%	0%	0%
Commission %	2%	2%	2%	2%	2%
Freight $/ADMT		$ -	$ -	$ -	$ -
Net Price	$ 666	$ 666	$ 666	$ 666	$ 686
Net Sales $000's	$ 3,332	$ 21,658	$ 10,996	$ 10,662	$ 5,488

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Total Sales ADMT					
MAC	36,000	12,000	18,000	18,000	18,000
MAC II	48,000	25,000	25,000	25,000	30,000
Weycell	18,000	27,000	36,000	36,000	36,000
Trucell	12,000	7,000	8,000	8,000	10,000
PH	4,000	10,000	10,000	10,000	10,000
Fluff	-	-	-	-	-
Ethers	-	1,500	1,500	2,000	3,000
Viscose	17,000	52,500	36,500	36,000	28,000
Total	135,000	135,000	135,000	135,000	135,000
Total Sales $/ADMT					
MAC	$ 914	$ 873	$ 873	$ 873	$ 897
MAC II	$ 914	$ 914	$ 914	$ 914	$ 938
Weycell	$ 835	$ 844	$ 838	$ 838	$ 886
Trucell	$ 944	$ 961	$ 914	$ 914	$ 938
PH	$ 637	$ 638	$ 638	$ 638	$ 687
Fluff	$ -	$ -	$ -	$ -	$ -
Ethers	$ -	$ 1,005	$ 1,005	$ 1,005	$ 1,005
Viscose	$ 666	$ 666	$ 666	$ 666	$ 686
Total	$ 867	$ 783	$ 802	$ 803	$ 849
Total Sales $000's					
MAC	32,892	10,476	15,715	15,715	16,147
MAC II	43,860	22,844	22,844	22,844	28,125
Weycell	15,026	22,784	30,169	30,169	31,897
Trucell	11,334	6,729	7,310	7,310	9,375
PH	2,548	6,383	6,383	6,383	6,874
Fluff	-	-	-	-	-
Ethers	-	1,507	1,507	2,009	3,014
Viscose	11,329	34,986	24,324	23,990	19,208
Total	116,989	105,709	108,250	108,419	114,639

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Production ADMT/Day rates					
MAC	376	376	376	376	376
MAC II	376	376	376	376	376
Weycell	376	376	376	376	376
Trucell	376	376	376	376	376
PH	423	423	423	423	423
Fluff	423	423	423	423	423
Ethers	376	376	376	376	376
Viscose	385	385	385	385	385
Average	378	383	382	382	381
Days Run - calculated					
MAC	96	32	48	48	48
MAC II	128	66	66	66	80
Weycell	48	72	96	96	96
Trucell	32	19	21	21	27
PH	9	24	24	24	24
Fluff	-	-	-	-	-
Ethers	-	4	4	5	8
Viscose	44	136	95	93	73
Total	357	353	354	354	354

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Wood Furnish					
Wood Cost - per Roy Nott					
$/BDT - Hemlock	$ 86.00	$ 86.00	$ 86.00	$ 86.00	$ 86.00
$/BDT - Hardwood	$ 76.00	$ 76.00	$ 76.00	$ 76.00	$ 76.00
Yield ADMT/BDT - per Truman Seeley					
MAC	0.35	0.35	0.35	0.35	0.35
MAC II	0.35	0.35	0.35	0.35	0.35
Weycell	0.35	0.35	0.35	0.35	0.35
Trucell	0.35	0.35	0.35	0.35	0.35
PH	0.40	0.40	0.40	0.40	0.40
Fluff	0.40	0.40	0.40	0.40	0.40
Ethers	0.35	0.35	0.35	0.35	0.35
Viscose	0.37	0.37	0.37	0.37	0.37
Chips BDT - calculated					
MAC	102,857	34,286	51,429	51,429	51,429
MAC II	137,143	71,429	71,429	71,429	85,714
Weycell	51,429	77,143	102,857	102,857	102,857
Trucell	34,286	20,000	22,857	22,857	28,571
PH	10,000	25,000	25,000	25,000	25,000
Fluff	-	-	-	-	-
Ethers	-	4,286	4,286	5,714	8,571
Viscose					
Hemlock (80%)	36,757	113,514	78,919	77,838	60,541
sub-total Hemlock	372,471	345,656	356,776	357,124	362,683
Hardwood (20% of Viscose)	9,189	28,378	19,730	19,459	15,135
Total BDT	381,660	374,035	376,506	376,583	377,819

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Chips $/ADMT					
MAC	$ 245.71	$ 245.71	$ 245.71	$ 245.71	$ 245.71
MAC II	$ 245.71	$ 245.71	$ 245.71	$ 245.71	$ 245.71
Weycell	$ 245.71	$ 245.71	$ 245.71	$ 245.71	$ 245.71
Trucell	$ 245.71	$ 245.71	$ 245.71	$ 245.71	$ 245.71
PH	$ 215.00	$ 215.00	$ 215.00	$ 215.00	$ 215.00
Fluff	$ -	$ -	$ -	$ -	$ -
Ethers	$ -	$ 245.71	$ 245.71	$ 245.71	$ 245.71
Viscose	$ 227.03	$ 227.03	$ 227.03	$ 227.03	$ 227.03
Average $/ADMT	$ 242.45	$ 236.17	$ 238.39	$ 238.46	$ 239.56
$000's	$ 32,731	$ 31,883	$ 32,182	$ 32,192	$ 32,341
Chemicals - per Truman Seeley					
$/ADMT					
MAC	$ 121.00	$ 121.00	$ 121.00	$ 121.00	$ 121.00
MAC II	$ 121.00	$ 121.00	$ 121.00	$ 121.00	$ 121.00
Weycell	$ 121.00	$ 121.00	$ 121.00	$ 121.00	$ 121.00
Trucell	$ 121.00	$ 121.00	$ 121.00	$ 121.00	$ 121.00
PH	$ 62.00	$ 62.00	$ 62.00	$ 62.00	$ 62.00
Fluff	$ 45.00	$ 45.00	$ 45.00	$ 45.00	$ 45.00
Ethers	$ 121.00	$ 121.00	$ 121.00	$ 121.00	$ 121.00
Viscose	$ 93.00	$ 93.00	$ 93.00	$ 93.00	$ 93.00
Average $/ADMT	$ 115.73	$ 105.74	$ 109.06	$ 109.16	$ 110.82
$000's	$ 15,623	$ 14,275	$ 14,723	$ 14,737	$ 14,961

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Energy					
$/ADMT					
MAC	$ 54.00	$ 54.00	$ 54.00	$ 54.00	$ 54.00
MAC II	$ 54.00	$ 54.00	$ 54.00	$ 54.00	$ 54.00
Weycell	$ 54.00	$ 54.00	$ 54.00	$ 54.00	$ 54.00
Trucell	$ 54.00	$ 54.00	$ 54.00	$ 54.00	$ 54.00
PH	$ 46.00	$ 46.00	$ 46.00	$ 46.00	$ 46.00
Fluff	$ 46.00	$ 46.00	$ 46.00	$ 46.00	$ 46.00
Ethers	$ 54.00	$ 54.00	$ 54.00	$ 54.00	$ 54.00
Viscose	$ 53.00	$ 53.00	$ 53.00	$ 53.00	$ 53.00
Average $/ADMT	$ 53.64	$ 53.02	$ 53.14	$ 53.14	$ 53.20
$/Op Day	$ 20,297	$ 20,294	$ 20,280	$ 20,280	$ 20,273
$000's	$ 7,241	$ 7,158	$ 7,174	$ 7,174	$ 7,182
Packaging					
$/ADMT					
MAC	$ 3.58	$ 3.58	$ 3.58	$ 3.58	$ 3.58
MAC II	$ 3.58	$ 3.58	$ 3.58	$ 3.58	$ 3.58
Weycell	$ 3.58	$ 3.58	$ 3.58	$ 3.58	$ 3.58
Trucell	$ 3.58	$ 3.58	$ 3.58	$ 3.58	$ 3.58
PH	$ 3.58	$ 3.58	$ 3.58	$ 3.58	$ 3.58
Fluff	$ 3.58	$ 3.58	$ 3.58	$ 3.58	$ 3.58
Ethers	$ 3.58	$ 3.58	$ 3.58	$ 3.58	$ 3.58
Viscose	$ 3.58	$ 3.58	$ 3.58	$ 3.58	$ 3.58
Average $/ADMT	$ 3.58	$ 3.58	$ 3.58	$ 3.58	$ 3.58
$000's	$ 483	$ 483	$ 483	$ 483	$ 483

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Mtce					
$/ADMT					
MAC	$ 157.00	$ 157.00	$ 157.00	$ 157.00	$ 157.00
MAC II	$ 157.00	$ 157.00	$ 157.00	$ 157.00	$ 157.00
Weycell	$ 157.00	$ 157.00	$ 157.00	$ 157.00	$ 157.00
Trucell	$ 157.00	$ 157.00	$ 157.00	$ 157.00	$ 157.00
PH	$ 138.00	$ 138.00	$ 138.00	$ 138.00	$ 138.00
Fluff	$ 138.00	$ 138.00	$ 138.00	$ 138.00	$ 138.00
Ethers	$ 157.00	$ 157.00	$ 157.00	$ 157.00	$ 157.00
Viscose	$ 154.00	$ 154.00	$ 154.00	$ 154.00	$ 154.00
Average $/ADMT	$ 156.06	$ 154.43	$ 154.78	$ 154.79	$ 154.97
$/Op Day	$ 59,054	$ 59,111	$ 59,074	$ 59,072	$ 59,054
$000's	$ 21,068	$ 20,848	$ 20,896	$ 20,897	$ 20,921
Wages					
$/ADMT					
MAC	$ 86.00	$ 86.00	$ 86.00	$ 86.00	$ 86.00
MAC II	$ 86.00	$ 86.00	$ 86.00	$ 86.00	$ 86.00
Weycell	$ 86.00	$ 86.00	$ 86.00	$ 86.00	$ 86.00
Trucell	$ 86.00	$ 86.00	$ 86.00	$ 86.00	$ 86.00
PH	$ 75.00	$ 75.00	$ 75.00	$ 75.00	$ 75.00
Fluff	$ 75.00	$ 75.00	$ 75.00	$ 75.00	$ 75.00
Ethers	$ 86.00	$ 86.00	$ 86.00	$ 86.00	$ 86.00
Viscose	$ 84.00	$ 84.00	$ 84.00	$ 84.00	$ 84.00
Average $/ADMT	$ 85.42	$ 84.41	$ 84.64	$ 84.65	$ 84.77
$/Op Day	$ 32,324	$ 32,310	$ 32,305	$ 32,305	$ 32,303
$000's	$ 11,532	$ 11,395	$ 11,427	$ 11,428	$ 11,444

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Salaries operating salaries only					
$/ADMT					
MAC	$ 38.77	$ 39.21	$ 39.10	$ 39.09	$ 39.04
MAC II	$ 38.77	$ 39.21	$ 39.10	$ 39.09	$ 39.04
Weycell	$ 38.77	$ 39.21	$ 39.10	$ 39.09	$ 39.04
Trucell	38.77	39.21	39.10	39.09	39.04
PH	34.46	34.86	34.75	34.75	34.70
Fluff	$ -	$ -	$ -	$ -	$ -
Ethers	$ -	$ 39.21	$ 39.10	$ 39.09	$ 39.04
Viscose	$ 37.82	$ 38.26	$ 38.14	$ 38.14	$ 38.09
Average $/ADMT	$ 38.52	$ 38.52	$ 38.52	$ 38.52	$ 38.52
$/Cal Day	$ 14,247	$ 14,247	$ 14,247	$ 14,247	$ 14,247
$000's	$ 5,200	$ 5,200	$ 5,200	$ 5,200	$ 5,200
Other Manufacturing					
$/ADMT					
MAC	$ 82.00	$ 82.95	$ 82.71	$ 82.70	$ 82.58
MAC II	$ 82.00	$ 82.95	$ 82.71	$ 82.70	$ 82.58
Weycell	$ 82.00	$ 82.95	$ 82.71	$ 82.70	$ 82.58
Trucell	$ 82.00	$ 82.95	$ 82.71	$ 82.70	$ 82.58
PH	$ 72.89	$ 73.73	$ 73.52	$ 73.51	$ 73.40
Fluff	$ -	$ -	$ -	$ -	$ -
Ethers	$ -	$ 82.95	$ 82.71	$ 82.70	$ 82.58
Viscose	$ 80.00	$ 80.93	$ 80.69	$ 80.68	$ 80.56
Average $/ADMT	$ 81.48	$ 81.48	$ 81.48	$ 81.48	$ 81.48
$/Cal Day	$ 30,137	$ 30,137	$ 30,137	$ 30,137	$ 30,137
$000's	$ 11,000	$ 11,000	$ 11,000	$ 11,000	$ 11,000

Cosmopolis Pulp Mill

Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Other Cash Costs					
IT Accounting HR Marketing	$ 1,035	$ 1,035	$ 1,035	$ 1,035	$ 1,035
Capital Spending	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000
Property Tax	$ 385	$ 385	$ 385	$ 385	$ 385
Insurance	$ 1,210	$ 1,210	$ 1,210	$ 1,210	$ 1,210
Total Other Cash Costs	$ 4,630	$ 4,630	$ 4,630	$ 4,630	$ 4,630
Total Manufacturing Cost					
$/ADMT					
MAC	$ 788.06	$ 789.46	$ 789.10	$ 789.09	$ 788.91
MAC II	$ 788.06	$ 789.46	$ 789.10	$ 789.09	$ 788.91
Weycell	$ 788.06	$ 789.46	$ 789.10	$ 789.09	$ 788.91
Trucell	$ 788.06	$ 789.46	$ 789.10	$ 789.09	$ 788.91
PH	$ 646.93	$ 648.17	$ 647.85	$ 647.84	$ 647.68
Fluff	$ -	$ -	$ -	$ -	$ -
Ethers	$ -	$ 789.46	$ 789.10	$ 789.09	$ 788.91
Viscose	$ 732.43	$ 733.79	$ 733.44	$ 733.43	$ 733.26
Average	$ 776.88	$ 757.34	$ 763.59	$ 763.78	$ 766.91
Total Manufacturing Margin $/ADMT					
$/ADMT					
MAC	$ 125.61	$ 83.57	$ 83.93	$ 83.94	$ 108.12
MAC II	$ 125.69	$ 124.29	$ 124.65	$ 124.66	$ 148.59
Weycell	$ 46.72	$ 54.40	$ 48.92	$ 48.93	$ 97.11
Trucell	$ 156.43	$ 171.79	$ 124.65	$ 124.66	$ 148.59
PH	$ (9.93)	$ (9.87)	$ (9.55)	$ (9.54)	$ 39.72
Fluff	$ -	$ -	$ -	$ -	$ -
Ethers	$ -	$ 215.04	$ 215.40	$ 215.41	$ 215.59
Viscose	$ (66.03)	$ (67.39)	$ (67.04)	$ (67.03)	$ (47.26)
Average	$ 89.71	$ 25.68	$ 38.27	$ 39.32	$ 82.27

Cosmopolis Pulp Mill
Pro-forma Financial Statement
Details and Assumptions

Economic Assumption = weak USD, problems at Pt Alice and Bacell

	2006	2007	2008	2009	2010
Total Manufacturing Margin $000's					
$000's					
MAC	$ 4,522	$ 1,003	$ 1,511	$ 1,511	$ 1,946
MAC II	$ 6,033	$ 3,107	$ 3,116	$ 3,117	$ 4,458
Weycell	$ 841	$ 1,469	$ 1,761	$ 1,762	$ 3,496
Trucell	$ 1,877	$ 1,203	$ 997	$ 997	$ 1,486
PH	$ (40)	$ (99)	$ (96)	$ (95)	$ 397
Fluff	$ -	$ -	$ -	$ -	$ -
Ethers	$ -	$ 323	$ 323	$ 431	$ 647
Viscose	$ (1,123)	$ (3,538)	$ (2,447)	$ (2,413)	$ (1,323)
Total	$ 12,111	$ 3,467	$ 5,166	$ 5,309	$ 11,106
Pre-tax Cash	$ 7,481	$ (1,163)	$ 536	$ 679	$ 6,476

ALTERNATIVES

Potential Site Alternatives

Overview

Our consulting team has been asked to consider other uses for the Cosmopolis mill facilities and site if the option of continuing the current pulpmill operation isn't deemed feasible. We have chosen to focus on uses that would employ some of the mill's existing human resources, infrastructure and the utility services that are already in place. The possibilities examined include:

1. Stand-alone bio-fueled power generating plant (this was covered in another report which was shared with the Advisory Committee on June 29, 2006)
2. A power generating plant with a residual heat user located on-site
   a. Fish rearing facility
   b. Lumber drying kilns
   c. ????
3. Existing mill and process reconfigured for ethanol (and methanol) production
4. Solvent process pulpmill with both pulp and chemical products

Other, more general uses of the site can, of course, be imagined (e.g. warehousing, cross-docking/distribution, etc.) but we have chosen to focus on potential uses that might best exploit the facility's more unique attributes.

The Mill as an Ethanol Plant

In the simplest conversion to an ethanol plant, the mill's brown stock system and recovery system would remain substantially intact. The red liquor from the cooking process would go through a fermentation/distillation plant for ethanol production and then on to the current recovery system. Meanwhile, the washed pulp would go through a process called 'cellulose hydrolysis' which would create a solution of simple wood sugars in water. This solution would then, in turn, go through a conventional fermentation and distillation step to produce ethanol, with part of the water recycled and part routed to the mill's current treatment system.

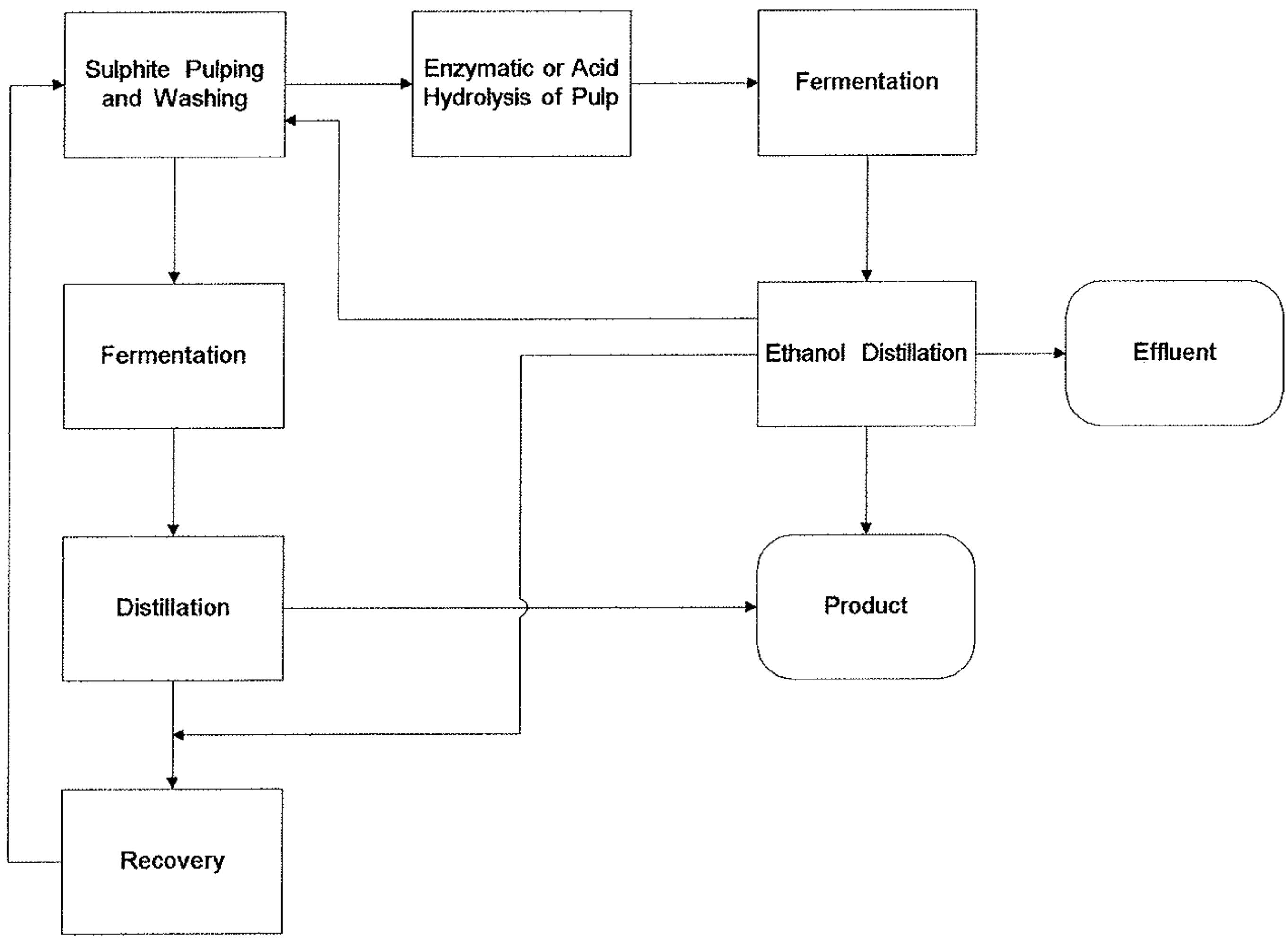
For a mill the size of Cosmopolis, the maximum theoretical yield of ethanol is roughly 37 million gallons per year. The more probable, realistic yield would likely be about 26 million gallons per year. This assumes the consumption of roughly 400,000 BDT's/year of wood. The current ethanol price, likely driven by tax incentives, an oxygenated fuel mandate, high petroleum prices and the current, general enthusiasm for bio-fuels, is roughly $2.50/gallon. At 26 million gallons per year, this suggests a gross revenue of about $65 million per year or roughly 55% of the current pulpmill revenue stream. This earnings stream might be enhanced slightly by sales of other by-products such as methanol and furfural. The mill's impact on ethanol market pricing would likely be negligible- the quantity produced would amount to less than .4% of the U.S. demand for ethanol in an E10 gasoline mix.

While the projection of revenues may seem somewhat disappointing, it does not necessarily mean that this business would be a 'loser'. Compared to the pulpmill operation, this new operation would essentially replace the pulp machine and bleach plant operations with hydrolysis, fermentation and distillation. With this configuration, the headcount requirement and chemical and energy costs should all be substantially reduced and the facility should have considerable feedstock flexibility (compared to a dissolving pulpmill), even permitting the use of species like hybrid cottonwood.

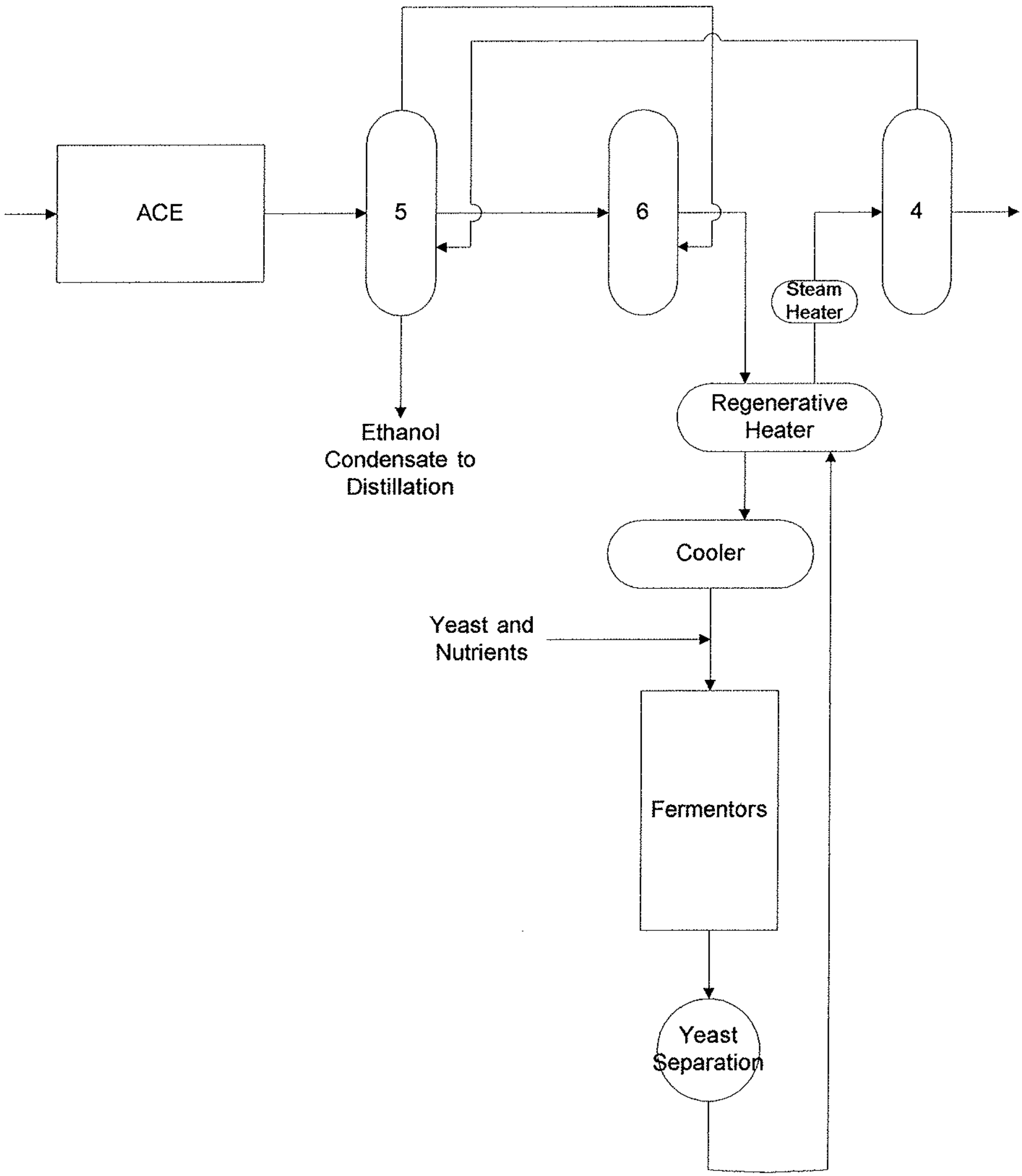
Substantial new capital investment would be required for the fermentation and distillation processes but both are pretty well developed technologies. The technology that is not well developed, on a commercial, larger scale basis, is cellulose hydrolysis. There are three known routes to the complete (or nearly complete) hydrolysis of cellulose: 1) concentrated acid hydrolysis, 2) dilute acid hydrolysis and 3) enzymatic hydrolysis. All three approaches have advantages and problems. Commercial concentrated acid hydrolysis requires recovery and re-concentration of the acid, a nasty step, to put it mildly. Dilute acid hydrolysis is hard to drive to completion. Enzymatic hydrolysis is apparently not economically feasible at present.

Because this option would require a very substantial new capital investment ($50 million?) and it would involve a critical process step (hydrolysis) that still seems to need substantial technological development, this clearly has the nature of a development project, a project that won't likely be undertaken without the support of a very risk-tolerant source of capital or some consortium or government agency.

Adding Ethanol Manufacture to the Existing Cosmopolis Mill



Adding Ethanol Manufacture to the Existing Cosmopolis Red Liquor System



By-Product Ethanol Production

One additional, important point should be made before we conclude our discussion of ethanol production opportunities at Cosmopolis. Ethanol production from this mill could occur in one of two ways, either as a by-product or (as mentioned in this review of mill alternatives) as a primary product. The by-product option involves the fermentation of the red liquor part way through the liquor evaporation process. This isn't 'brain surgery'- sulfite mills have been doing this since the 1940's. The only unanswered question is whether there is some problem of compatibility with the mill's magnesium base. Most (if not all) of the mills that do this are calcium-based. Truman doesn't think this should be a problem but it needs to be studied. Probable mill ethanol yield, under this by-product ethanol option, is likely on the order of between 4 and 5 million gallons per year which (using the assumptions made previously) implies an incremental revenue stream of between \$7 and \$12 million. There may be some operating cost impacts of this approach but the big cost item- the chip cost- would obviously be unaffected.

Truman has suggested that, if he were still running the mill and he wasn't under corporate orders to shut it down, 'he would be all over this one'. In addition to this valuable new revenue stream, this option might even permit some incremental mill recovery debottlenecking. Theoretically, this might permit the mill to make a modest (3%?) throughput improvement.

In the primary ethanol product mode, there would be two separate fermentation lines, one for red liquor and one for the hydrolyzed pulp sugars. We haven't identified a way to combine them.

Competitive Methods of Ethanol Manufacture

Ethanol may be synthesized from petroleum, a proven approach once dominant for industrial purposes but now seldom mentioned. Most of the bio-fuel ethanol that is now produced in the U.S. is made by fermentation of feed corn. With a typical yield of 2.7 gallons per bushel and corn prices ranging from \$2.00 to \$3.50 per bushel, the raw material costs are pretty comparable to wood (see attached ethanol feedstock cost analysis). The operating costs for producing ethanol from corn are substantial because the starches must be enzymatically degraded to sugars before fermentation.

Ethanol is produced in Brazil by fermentation of sugar cane juice, a somewhat simpler process. This process is reportedly uneconomical in the U.S. because of subsidized sugar prices. Furthermore, the Brazilian export of ethanol to the U.S. is apparently uneconomic because of substantial tariff barriers.

Ethanol Feedstock Cost Analysis

A. Ethanol from corn

1. Corn yield per acre (US average)- 139 bushels/acre
2. Ethanol yield from corn- 2.7 gal/bushel
3. Current feed corn price range- $2 to $3.50/bushel
4. Therefore, $/gallon for ethanol from feed corn- $.74 to $1.30/gallon

B. Ethanol from wood

1. Assume utilization of only hexose sugars in fermentation
2. Most woods are roughly 60% hexose sugars
3. Theoretical yield from anaerobic metabolism of hexose is 57% by mass
4. Price of wood is $60 to $100/BDT
5. Wood yield per acre is about 4 BDT/acre/year
6. Ethanol density is 0.789 kg/m3 or 6.581 pounds/gallon
7. So, at 100% of theoretical yield, feedstock cost range is:

$$\$/\text{gallon} = \frac{(60)(6.58)}{(2000)(.51)(0.6)} = \$0.65 \text{ at } \$60/\text{BDT}$$

$$\$/\text{gallon} = \frac{(100)(6.158)}{(2000)(.51)(0.6)} = \$1.08 \text{ at } \$100/\text{BDT}$$

8. Limited data available suggests a recovery vs. theoretical on the order of 70%, implying a feedstock cost range of $.93 to $1.54/gallon.
9. Yield per acre corresponding to a 4BDT/acre/year growth rate, a hexose content of 60% and a yield of ethanol at 70% of theoretical is:

$$\frac{(0.7)(4)(2000)90.51)(.6)}{6.58} = 260 \text{ gallons/acre/year}$$

Conclusion: In the 'contest' between corn and wood, the favorable energy balance for wood should offset a slight corn feedstock cost advantage, Corn by-products may swing the balance back. The 'devil is in the details'. For further information, see the article attached at the end of this section entitled, 'The 2001 Net Energy Balance of Corn'.

The Bio-Refinery Pulpmill

In this concept, the mill's basic process is altered. Sulfite pulping is replaced by an organic solvent step, possibly catalyzed, to accomplish the basic pulping. Most of the lignin and hemicellulose from pulping winds up in solution and the pulp continues along as it currently does for further processing. Lignin and hemicellulose are separated, usually by precipitation of the lignin, and the lignin is recovered as a saleable by-product. The hemicellulose can be fermented to ethanol. The conventional chemical recovery step is eliminated.

Processes such as these have reached the semi-commercial stage in the past and then failed for various reasons. One reason is poor product definition. Exactly where and to whom does one sell precipitated lignin? We, at Paneltech, would have an interest in this lignin as a phenol replacement for PF resins but, once again, the 'devil is in the details'. Furthermore, the ethanol that was produced was not an economically desirable product until quite recently. Finally, and perhaps most importantly, the pulp from these processes have proven to be inferior to the more 'normal' pulps. Capital costs and technology problems are significant but there are companies that have expressed an interest in finding a demonstration site.

The Mill as a Stand-Alone Power Generating Facility

A separate report, exploring this subject more fully, has been prepared and distributed to the Advisory Committee.

THE 2001 NET ENERGY BALANCE OF CORN-ETHANOL

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ABSTRACT

This report estimates the net energy balance of corn ethanol utilizing the latest survey of U.S. corn producers and the 2001 U.S. survey of ethanol plants. The major objectives of this report are to improve the quality of data and methodology used in the estimation. This paper also uses ASPEN Plus, a process simulation program, to allocate total energy used to produce ethanol and byproducts. The results indicate that corn ethanol has a positive energy balance, even before subtracting the energy allocated to by products. The net energy balance of corn ethanol adjusted for byproduct credits is 27,729 and 33,196 Btu per gallon for wet- and dry-milling, respectively, and 30,528 Btu per gallon for the industry. The study results suggest that corn ethanol is energy efficient, as indicated by an energy output/input ratio of 1.67.

Keywords: Corn-ethanol, energy inputs, dry-and wet-milling, net energy balance

INTRODUCTION

USDA's net energy balance of corn-ethanol was published in 1995, 2002, and 2003 in the American Society of Agricultural Engineers (ASAE), Shapouri et al. Since 1970, many authors have studied the net energy balance of corn-ethanol. The major objective of this report is to improve the general estimation procedure. These improvements include: (1) regular updating of the estimates based on the latest data on corn production and corn yield, (2) improving the quality of estimates for energy used in manufacturing and marketing nitrogen fertilizer, (3) improving the quality of estimates for energy used to produce seed-corn, and (4) enhancing the methodologies used in allocating the energy used in ethanol production (to byproducts and ethanol). In contrast to three previous studies, all energy inputs are reported in low-heat value (LHV).

During the past 2 years, David Pimentel, 2003, Tad Patzek, 2003, and Andrew Ferguson, 2003, criticized USDA's studies of the net energy balance of corn ethanol. It is argued that USDA underestimates energy used in the production of nitrogen fertilizer and the energy used to produce seed-corn, over estimating the energy allocated to produce corn-ethanol byproducts. They also argued that USDA excludes energy used in corn irrigation and secondary energy inputs used in the production of corn, such as farm machinery and equipment and cement, steel, and stainless steel, used in the construction of ethanol plants.

THE NET ENERGY BALANCE

This paper, unlike the Dr. Pimentel report, 2003, is based on straightforward methodology and highly regarded quality data from the 2001 Agricultural Resource Management Survey (ARMS), Economic Research Service, ERS/USDA, 2001 Agricultural Chemical Usage, and 2001 Crop Production, National Agricultural Statistics Service, NASS/USDA, and the 2001 survey of ethanol plants.

Direct energy used on farms, such as gasoline, diesel, LP gas (LPG), natural gas, and electricity, for the production of corn, including irrigation by States from 2001 ARMS, are available on the ERS Web site. The number of seed-corn planted per acre in 2001, custom work expenditure, tons of lime used per acre, and purchased water were also from the 2001 ARMS. Quantities of fertilizers and pesticides used per acre of corn in 2001 were published by NASS. Although corn is produced in every State, we focused our analysis on the major corn-producing States: Illinois, Indiana, Iowa, Minnesota, Nebraska, Ohio, Michigan, South Dakota, and Wisconsin. In 2001, these nine States accounted for 79 and 92 percent of U.S. corn and ethanol production, respectively.

Corn yield is a critical part of the net energy balance estimation. Although the corn yield has been rising over time, the annual variation is very volatile. Therefore, we used a 3-year average yield instead of the average yield for the survey year. The 2000-02 weighted average corn yield in each State was used to convert farm inputs from a per acre basis to a per bushel basis (2001 Crop Production, NASS). Table 1 shows the nine-State energy input data per acre of corn and nine-State weighted average for the 2001 ARMS.

Table 1--Energy-related inputs used to grow corn in nine States and nine-State weighted average, 2001

		IL	IN	IA	MN	NE	OH	MI	SD	WI	9-State Weighted average
Yield 2000-02 average	Bushels/acre	146.31	141.85	152.06	144.35	133.66	125.8	114.78	105.82	131.48	139.34
Seed	Kernels/acre	29158	28281	29855	30816	26619	28934	27867	25270	29860	28739
Fertilizer:											
Nitrogen	pounds/acre	154.53	147.33	125.04	113.74	131.73	168.3	125.52	109.09	106.6	133.52
Potash	pounds/acre	116.81	132.32	68.72	61.82	21.14	112	102.1	31.99	56.01	88.2
Phosphate	pounds/acre	80.88	67.28	57.32	46.31	35.18	67.39	50.06	45.54	37.43	56.81
Lime	pounds/acre	20	20	20	0	0	20	20	0	60	15.67
Energy:											
Diesel	Gallons/acre	3.7	4.6	4.6	5.4	12.4	4.3	7.2	4.4	7.4	6.85
Gasoline	Gallons/acre	1.5	2.1	1.2	1.7	2.1	1.6	2.5	1.5	1.4	3.4
LPG	Gallons/acre	2.8	3.2	7.2	8.5	4.1	5.6	3.6	0.5	1.9	3.42
Electricity	kWh/acre	9.6	28.3	16.8	26.8	152.5	10	25.5	27.4	6.6	33.59
Natural Gas	Cubic ft/acre	76.9	144.2	0	45.8	964	164	223.1	7	124	245.97
Custom work	Dol./acre	13.45	7.8	9.9	8.58	7.93	8.29	9.8	9.3	15.26	10.12
Chemicals	Pounds/acre	3.28	3.19	2.84	2	2.17	3.7	3.15	1.83	2.17	2.66
Purchased water	Dol./acre	0	0	0	0	1.2	0	0	0	0	0.18

Source: USDA, Economic Research Service and Office of Energy Policy and New Uses.

In previous studies, we assumed that energy used to produce seed-corn is equal to 1.5 times the energy used to produce corn. The review of literature and comments on our reports indicated that seed-corn production requires more energy because the seed-corn yield per acre is low and requires a considerable amount of electrical energy to process seed-corn including drying, shelling, grading, cleaning and storage. Based on an unpublished report prepared by Michael Graboski, 2002, for the National Corn Grower Association, the energy required for growing and processing seed-corn is estimated at 4.7 times that required for production of corn. The factor of 4.7 is used in this study.

The amount of energy used to produce a pound of nitrogen has been estimated in several studies. The values range from 18,392 Btu of high heat value (HHV) per pound, Shapouri et al, 2002, to over 33,590 Btu LHV per pound, Pimentel 2003. For this report, we asked Keith Stokes, President of the Stokes Engineering Company and fertilizer expert, to estimate the energy used in the production of nitrogen, phosphate, and potash fertilizers. His estimates of energy used (LHV) to make and deliver nutrients are 24,500 Btu per pound of N, 4,000 Btu per pound of P_2O_5, and 3,000 Btu per pound of K_20.

The energy used to produce herbicides and insecticides are from Wang et al.1999, the Greenhouse Gas Regulated Emissions and Energy Use in Transportation (GREET) model, Argonne National laboratory. More than 153,000 Btu of energy is required to produce a pound of herbicides, and about 158,000 Btu of energy is required to produce a pound of insecticides. A weighted average of over 154,000 Btu of energy is used per pound of pesticides. Farm-related energy inputs are converted per bushel and then to Btu of energy per bushel of corn by multiplying each input by its LHV. The energy required for hauling these inputs to farms, excluding fertilizer, was also estimated. The energy used to produce fertilizers includes energy used to deliver fertilizer to farm. The total energy requirements for farm inputs are given in Table 2.

The energy associated with transporting the corn from local storage facilities to ethanol plants was estimated by the GREET model. The average energy used for transporting a bushel of corn was 5,636 Btu or about 2,120 Btu per gallon of ethanol.

Ethanol production facilities include both dry- and wet-milling operations. Dry mills are usually smaller than wet mills and are built primarily to produce ethanol. Wet mills are bio-refineries and produce a wide range of products such as ethanol, high fructose corn syrup (HFCS), starch, food and feed additives, and vitamins. Thermal and electrical powers are the main types of energy used in both types of processing plants. Wet mills usually generate both electrical and thermal energy from burning natural gas or coal. Dry mills use natural gas to produce steam and purchase electricity from a utility.

The energy used to convert corn to ethanol is based on a U.S. survey conducted in 2001 by BBI International. On the average, dry mill ethanol plants used 1.09 Kwh of electricity and about 34,700 Btu of thermal energy (LHV) per gallon of ethanol. When energy losses to produce electricity and natural gas were taken into account, the average dry mill ethanol plant consumed about 47,116 Btu of primary energy per gallon of ethanol produced. Wet mill ethanol plants that participated in the survey used 49,208

Table 2--Total energy requirements of farm inputs for nine State and nine-State weighted average, 2001

	IL	IN	IA	MN	NE	OH	MI	SD	WI	9-State Weighted average
					BTU/bushel					
Seed	525	557	451	512	804	780	827	623	548	603
Fertilizer:										
Nitrogen	25876	25446	20147	19305	24148	32764	26792	25257	19864	23477
Potash	2395	2798	1356	1285	474	2670	2669	907	1278	1899
Phosphate	2211	1897	1508	1283	1053	2142	1745	1721	1139	1631
Lime	76	79	73	0	0	89	97	0	255	63
Energy:										
Diesel	3853	4941	4609	5700	14136	5207	9558	6336	8576	7491
Gasoline	1478	2135	1138	1698	2266	1834	3141	2044	1536	3519
LPG	1644	1938	4067	5058	2635	3823	2694	406	1241	2108
Electricity	614	1868	1035	1739	10685	744	2081	2425	470	2258
Natural Gas	550	1063	0	332	7544	1363	2033	69	986	1846
Custom work	2001	1197	1417	1294	1291	1434	1859	1913	2526	1581
Chemicals	3453	3464	2877	2134	2501	4530	4227	2664	2542	2941
Purchased water	0	0	0	0	946	0	0	0	0	136
Input hauling	143	167	178	176	242	209	254	121	251	202
Total	44821	47551	38856	40516	68723	57590	57977	44486	41212	49753

Btu per gallon of natural gas and coal, on average, to produce steam and electricity in the plants. After adjustments for energy losses to produce natural gas and coal, on the average, a wet mill ethanol plant used 52,349 Btu of energy to make a gallon of ethanol.

The average energy associated with the transport of ethanol from ethanol plants to refueling stations was estimated by the GREET model. The average energy used for transporting a gallon of ethanol was 1,487 Btu per gallon for both dry and wet milling.

The production of ethanol comes with a range of byproducts, such as distillers dried grains with soluble (DDGS) in the dry milling operation, and corn gluten feed (CGF), corn gluten meal (CGM), and corn oil in the wet milling process. The energy used to produce corn and convert corn to ethanol, including hauling corn from farms or grain elevators to ethanol plants, should be allocated to ethanol and byproducts.

In the previous studies, we used a replacement method to allocate total energy to ethanol and byproducts. For this report, we used ASPEN Plus, a process simulation program, to allocate the energy used in the plants to ethanol and byproducts. On the average, 59 and 64 percent of the energy used to convert corn to ethanol is allocated to ethanol in dry- and wet-mills respectively.

Energy is used to produce and transport corn to ethanol plants allocated to starch and other corn kernel components, such as fiber, germ, and protein. Only starch is converted to ethanol. On the average, starch accounts for 66 percent of the corn kernel weight (15 percent moisture). Therefore, 66 percent of energy used to produce and transport corn to ethanol plants is allocated to ethanol and 34 percent to byproducts.

Energy used in the production of secondary inputs, such as farm machinery and equipment used in corn production, and cement, steel, and stainless steel used in the construction of ethanol plants, are not included in our study. Available information in this area is old and outdated. Pimentel, in his latest report (2003), used the 1979 Slesser and Lewis to estimate the energy used in the production of steel, stainless steel, and cement.

RESULTS

All energy inputs used in the production of ethanol is adjusted for energy efficiencies developed by GREET model. The estimated energy efficiencies are for gasoline (80.5 percent), diesel fuel (84.3 percent), LPG (98.9 percent), natural gas (94 percent), coal (98 percent), electricity (39.6 percent), and transmission loss (1.087 percent). After adjusting the energy inputs by these energy efficiencies, the total estimated energy required to produce a bushel of corn in 2001 was 49,753 Btu.

Table 3 summarizes the input energy requirements, by phase of ethanol production on a Btu per gallon basis (LHV) for 2001, without byproduct credits. Energy estimates are provided for both dry- and wet-milling as well as industry average. In each case, corn ethanol has a positive energy balance, even before subtracting the energy allocated to byproducts.

Table 4 presents the final net energy balance of corn ethanol adjusted for byproducts. The net energy balance estimate for corn ethanol produced from wet-milling is 27,729 Btu per gallon, the net energy balance estimate for dry-milling is 33,196 Btu per gallon, and the weighted average is 30,528 Btu per gallon. The energy ratio is 1.57 and 1.77 for wet- and dry-milling, respectively, and the weighted average energy ratio is 1.67.

Table 3--Energy use and net energy value per gallon without coproduct energy credits, 2001

Production process	Milling process Dry	Milling process Wet	Weighted average
	Btu per gallon		
Corn production	18875	18551	18713
Corn transport	2138	2101	2120
Ethanol conversion	47116	52349	49733
ethanol distribution	1487	1487	1487
Total energy used	69616	74488	72052
Net energy value	6714	1842	4278
Energy ratio	1.10	1.02	1.06

Table 4--Energy use and net energy value per gallon with coproduct energy credits, 2001

Production process	Milling process Dry	Milling process Wet	Weigted average
	Btu per gallon		
Corn production	12457	12244	12350
Corn transport	1411	1387	1399
Ethanol conversion	27799	33503	30586
ethanol distribution	1467	1467	1467
Total energy used	43134	48601	45802
Net energy value	33196	27729	30528
Energy ratio	1.77	1.57	1.67

REFERENCES

Ferguson, A. 2003. *Implication of the USDA 2002 Update on Ethanol from Corn.*Vol.3, No 1. Manchester, UK.: The Optimum Population Trust.

Graboski, Michael. 2002. *Fossil Energy Use in the Manufacturing of Corn Ethanol.* Denver, CO.: Colorado School of Mines.

Patzek, Tad. & CE24 Freshman Seminar Students. 2003. *Ethanol from Corn: Clean Renewable Fuel for the Future, or Drain on our Resources and Pockets? Vol. 12, No. 2,* Netherlands.: *Natural Resources Research,* Kluwer Academic Publishers.

Pimentel, David. 2003. *Ethanol Fuel: Energy Balance, Economics, and Environmental Impacts are Negative*. Vol.12, No.2.: 2003 International Association for Mathematical Geology, Natural Resources Research,
Shapouri, H., J.A. Duffield, and M. Wang. 2003.*The Energy Balance of Corn Ethanol Revisited*.: 2003 American Society of Agricultural Engineers, Vol.46 (4): 959-968.
Shapouri, H., J.A. Duffield, and M. Wang. 2002.*The Energy Balance of Corn Ethanol: An Update*. AER-814. Washington, D.C.: USDA Office of the Chief Economist.
Shapouri, H., J.A. Duffield, and M.S. Graboski. 1995. *Estimating the Net Energy Balance of Corn Ethanol*. AER-721. Washington, D.C.: USDA Economic Research Service.
Stokes, Keith. *2004. Estimate of Energy Used to Make and Deliver N, P, and K Fertilizer to the Farm Gate*. Weston, CT.: 2004 Special Reports for the USDA/OCE, Stokes Engineering Company.
USDA-ERS. 2001. *Commodity Costs and Returns, Energy Use on Major Field Crops in Surveyed States.* Washington, D.C.: *USDA Economic Research Service.* www.ers.usda.gov/Data/CostsAndReturns/testpick.htm.
USDA-NASS. 2001. *Agricultural Chemical Usage, 2001 field Crops Summary*. Washington, DC.: USDA National Agricultural Statistics Service.
USDA-NASS. 2001. *Field Crops 2001 Crop Production.* Washington, DC.: USDA National Agricultural Statistics Service.
Wang, M., C. Saricks, and D. Santini. 1999. *Effects of Fuel Ethanol Use on Fuel-Cycle Energy and Greenhouse Gas Emissions*. Argonne, IL.: USDOE Argonne National laboratory, Center for Transportation Research.